Smolt Passage Behavior and Flow-net Relationships in the Forebay of John Day Dam

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National Oceanic and Atmospheric Administration
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ERRATA

Spillbay locations on the graphical representations (Appendix B) are in error. In preparing this report, identification numbers (l-20) associated with the 20 spillbays were mistakenly assigned in increasing order from the powerhouse toward the Washington shore. In actuality, Spillbay No. 1 is nearest the Washington shore and Spillbay No. 20 is adjacent to the powerhouse. Consequently, the actual spill patterns are the mirror images of those depicted in Appendix B. All future reports will contain the true spill patterns.

SMOLT PASSAGE BEHAVIOR AND FLOW-NET RELATIONSHIPS IN THE FOREBAY OF JOHN DAY DAM

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ABSTRACT

During 1983, the research program had three separate but complementary phases--monitoring current patterns in the forebay, defining fish distribution with purse seine sampling, and describing the migration routes of salmonid smolts using radio tracking techniques.

Preliminary results from the radio-tracking and purse seining operations in FY83 suggest that the discharge from the John Day River and the turbid plume it forms in the forebay may have a pronounced effect on the distribution of smolts, especially chinook and sockeye salmon, as they approach the dam. The implication of these data is that the plume may be shunting salmon toward the Washington (spill) side of the river where they would be more susceptible to spill passage. This resulted in higher spill passage of tagged chinook salmon than the proportion of water being spilled. In contrast, spillway passage of steelhead not influenced by the plume is approximately the same as the proportion of water being spilled. These findings are based on limited data and must be considered preliminary at this time. Data describing the current patterns have just recently been reduced to a usable format and have not yet been correlated with findings from radio tracking and purse seining. Such data will be incorporated into an overall analysis of the relations of current patterns and John Day River discharge to fish migration patterns. Representative examples of prevailing current patterns during the spring migration have been completed and are included in this document.

INTRODUCTION

Even though collection and transportation facilities are operating at key dams in the Snake-Columbia River System, significant numbers of juvenile salmonids continue to migrate downstream past dams on their own volition (Sims et al. 1982). Mortality through spillways is approximately 3% (Bell et al. 1972) contrasted to mortalities of 15% and higher through turbines (Long et al. 1968). Improved fingerling bypass systems are being developed to ensure the safe passage of these migrants as they encounter the numerous dams on their seaward journey (McConnell and Muir 1982; Swan et al. 1983).

Special flows, spills, and operating techniques at dams such as John Day that have inadequate bypass (Sims and Johnson 1977) are also being used to enhance Smolt survival. These techniques are executed on the premise that the current system (flow-net) in each forebay responds to dam operations and that smolts in turn respond to the flow-net, as suggested by previous juvenile radio tracking studies conducted by the National Marine Fisheries Service (NMFS) in John Day forebay (Sims et al. 1981; Faurot et al. 1982).

The ultimate objective of the research program reported herein is to define the flow-net in the forebay of John Day Dam over a range of flow conditions and dam operations and relate it to Smolt passage behavior. Such information is fundamental in assessing the effectiveness of providing special flows and dam operations and may also be useful in the design of fingerling bypass systems. To advance toward the ultimate objective, it was necessary to begin systematically gathering current data and developing the computer software required to process and analyze the data. During

1982 and 1983, efforts were concentrated on these initial facets of the program.

Also in 1983, two additional phases were implemented--a purse seining program to define the distribution of fish in the forebay and a radio tracking study designed to identify the routes which juvenile salmonids take as they move downstream.

FISH DISTRIBUTION AND CURRENT METER DATA

Methods and Materials

Purse Seining

From 20 April to 26 May 1983, purse seine sampling activities were conducted with the Northwest and Alaska Fisheries Center's (NWAFC) research vessel "Columbia," an 11-m power block seiner. Nine sampling stations were established (Figure 1). Upstream sets were made between 1200 and 1900 h; salmonid catches were enumerated by species. At each station a mean secchi disk value was calculated from three readings, and representative surface water temperatures were recorded at selected locations. Data are detailed in Appendix Table Al. Purse seining was scheduled to coincide with radio tracking activities in an effort to assess whether routes taken by radio tagged juvenile salmon are truly representative of the general population traversing the forebay.

Current Meter Data

From 21 April to 4 October 1983, 11 self-contained, magnetic recording current meters were deployed in the forebay of John Day Dam. The meters were secured to a self-adjusting buoy system which maintained them at a constant depth, 3 m below the surface of the reservoir. The 1983 sampling grid was more expansive than that of 1982 and extended upriver nearly 2 km

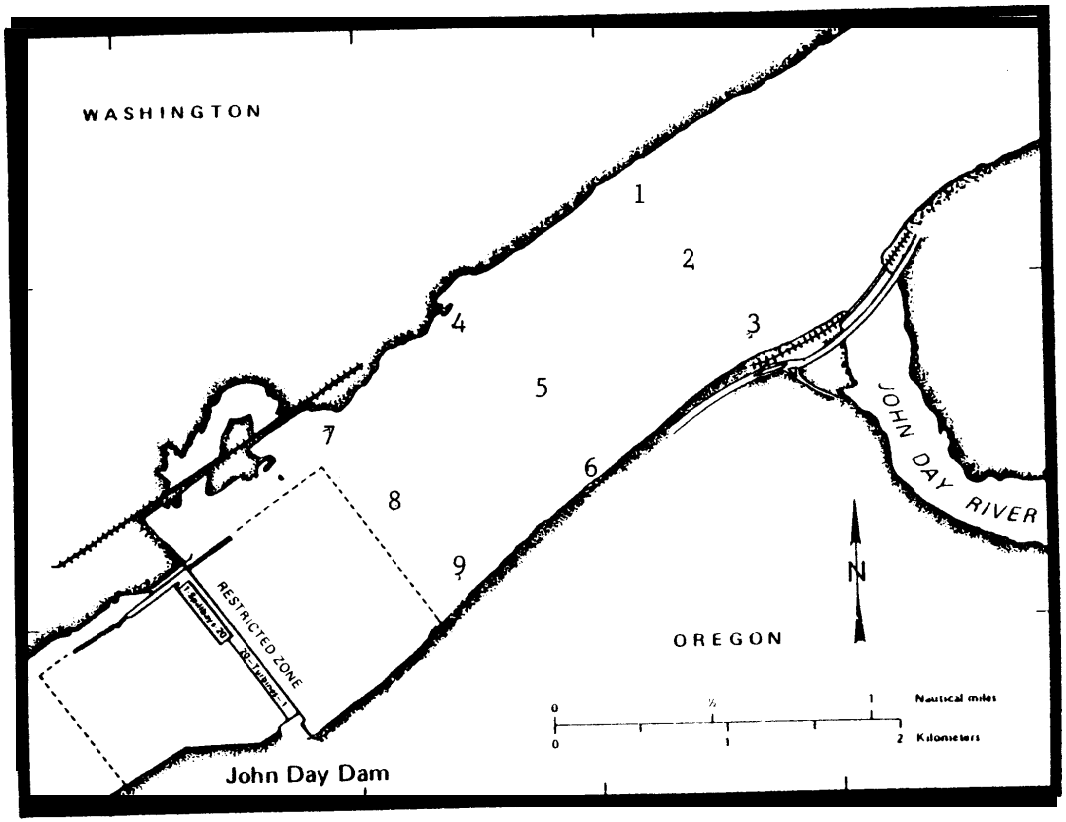

Figure 1.--Purse seine sampling stations - 1983.

from the dam. A 12th meter was used to take readings at various other locations in the forebay and also acted as a backup when any deployed in the grid would malfunction. Current velocity and direction were measured for an 8-min interval each hour. Cassette tapes and battery packs were replaced monthly to ensure that the meters continued to operate throughout the field season.

Cassettes with encoded data were read into the Burroughs 7800 mainframe computer at the NWAFC.[1/] Three different tasks in software development were undertaken: (1) data error checking and editing, (2) data base evaluations, and (3) graphical representation.

Results

Fish Distribution

From 20 April to 26 May 1983, 70 purse seine sets were executed (Appendix Table A1). Over the course of the study, 8,028 juvenile salmonids (3,404 yearling chinook salmon, 2,348 steelhead, 2,042 sockeye salmon, 226 coho salmon, and 8 subyearling chinook salmon) were caught, identified by species, and released. The number of sets on a given sampling date ranged from three to seven depending on prevailing weather conditions and the number of fish which were captured and had to be sorted. During the sampling program, there were six dates on which at least the same six stations [1-3, 7-9 were sampled, (Figure 1)], thus providing six comparative periods of fish distribution in the forebay. For each of three

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1/Reference to trade name does not imply endorsement by the National Marine Fisheries Service, NOAA.

species (yearling chinook salmon, steelhead, and sockeye salmon) daily catch at each station was expressed as the percentage of the total caught at all six stations (Appendix Table A2). The general distribution patterns for yearling chinook salmon and sockeye salmon remained similar over the entire month; fish were concentrated near the Washington shore and were rarely encountered at sampling stations near the Oregon shore, especially at Station 3 (Figures 2 and 3). Steelhead, although showing the same broad tendency to accumulate on the Washington side of the river, did not concentrate there to the extent or the degree of regularity of either chinook or sockeye salmon (Figures 4 and 5). Discharge from the John Day River may be influencing the distribution of the chinook and sockeye salmon.

The John Day Dam River enters the Columbia River several hundred meters upstream from Station 3 (Figure 1). The John Day River during the spring runoff is typically warmer and more turbid than the Columbia River, so much so that a visible turbid plume emanates from its mouth and can often extend to the Washington shore. As a result, water clarity (secchi disk reading) varied throughout the forebay from 42 to 120 cm (Figure 6). The low water visibilities (41-60% of the maximum secchi disk reading each day) were consistently exhibited near the mouth of the John Day River and downstream near the Oregon shore, while the higher visibilities (81-100%) occurred in areas farthest from the John Day River near the Washington shore (Figure 7). Data from the juvenile radio tracking (discussed later) suggests that salmon, but not steelhead, tended to avoid the turbid water and thus ended up in the clearer water near the Washington shore.

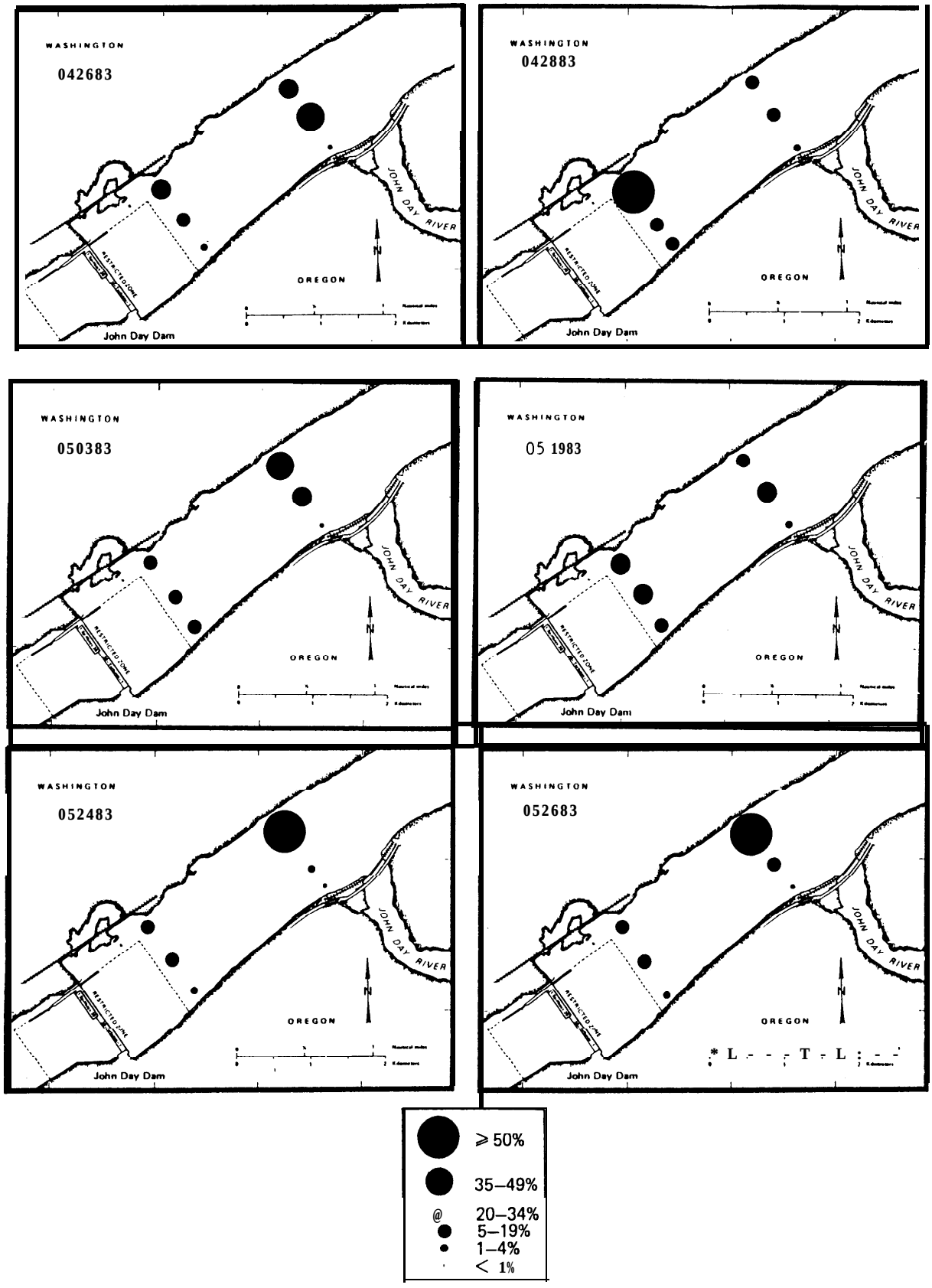


Figure 2.--Distribution of juvenile chinook salmon in the forebay of John Day Dam. Data are expressed as a percentage of the total daily catch at the six stations.

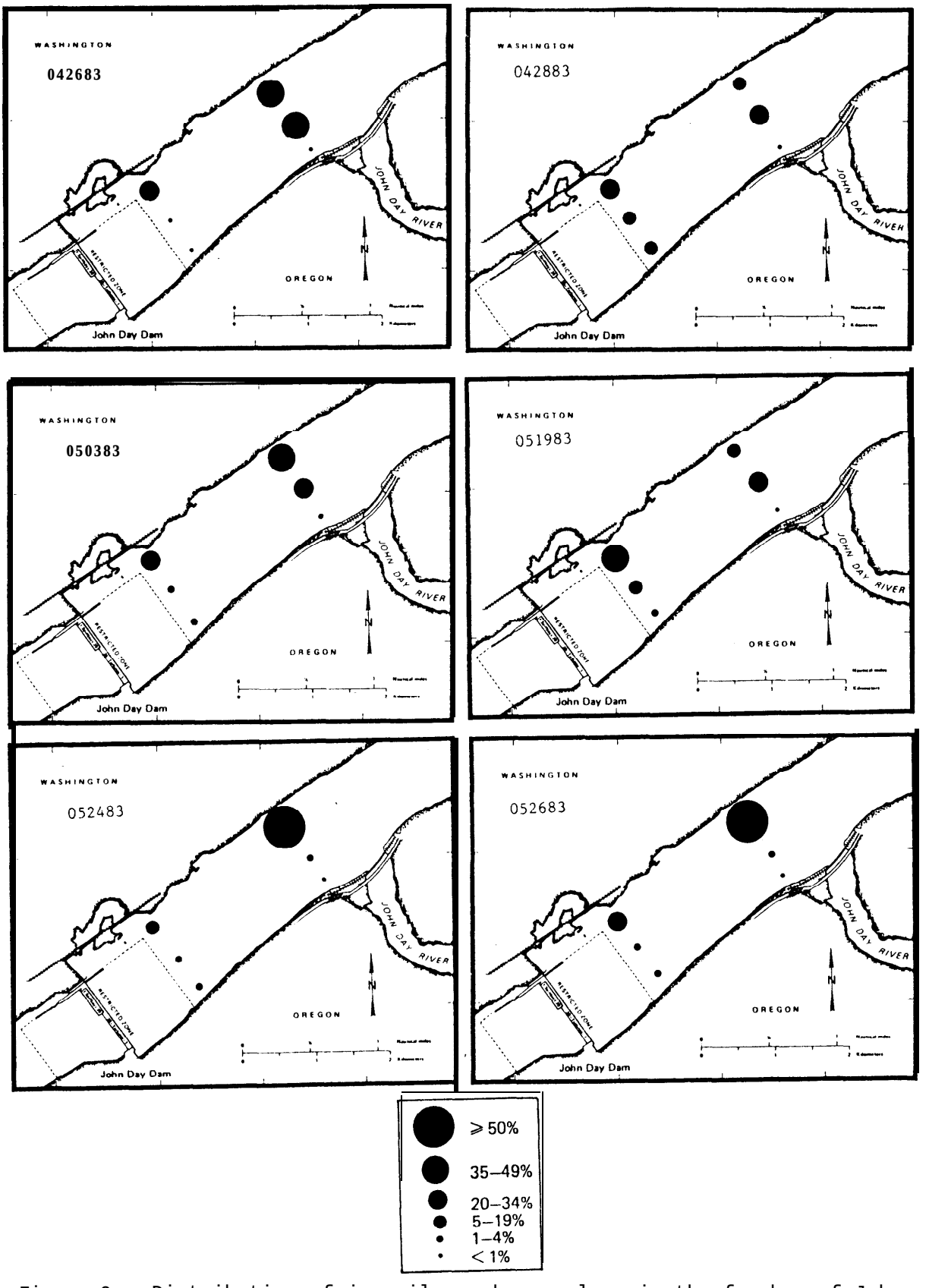


Figure 3.--Distribution of juvenile sockeye salmon in the forebay of John Day Dam. Data are expressed as a percentage of the total daily catch at the six stations.

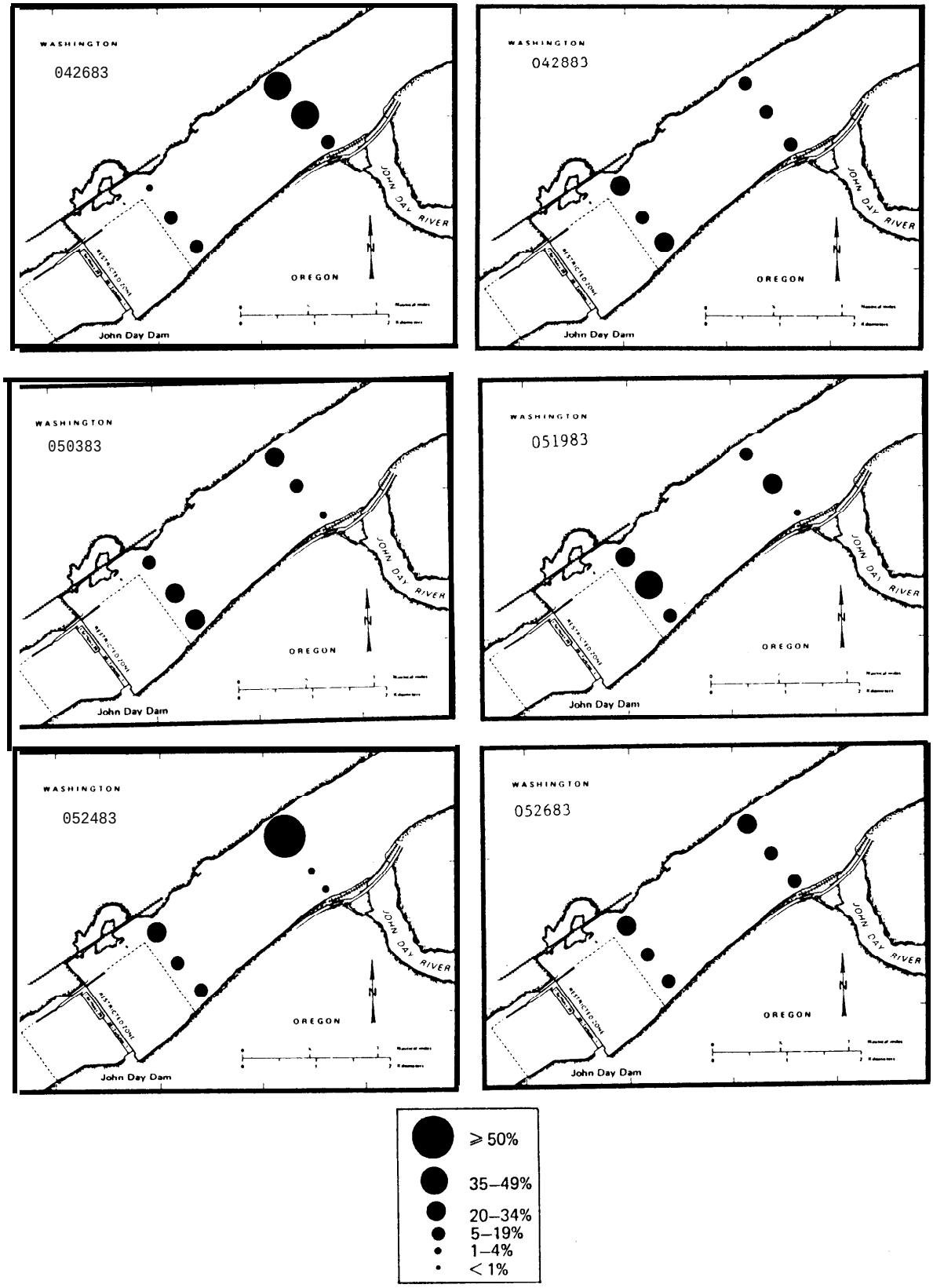


Figure 4.--Distribution of juvenile steelhead in the forebay of John Day Dam. Data are expressed as the percentage of the total daily catch at the six stations.

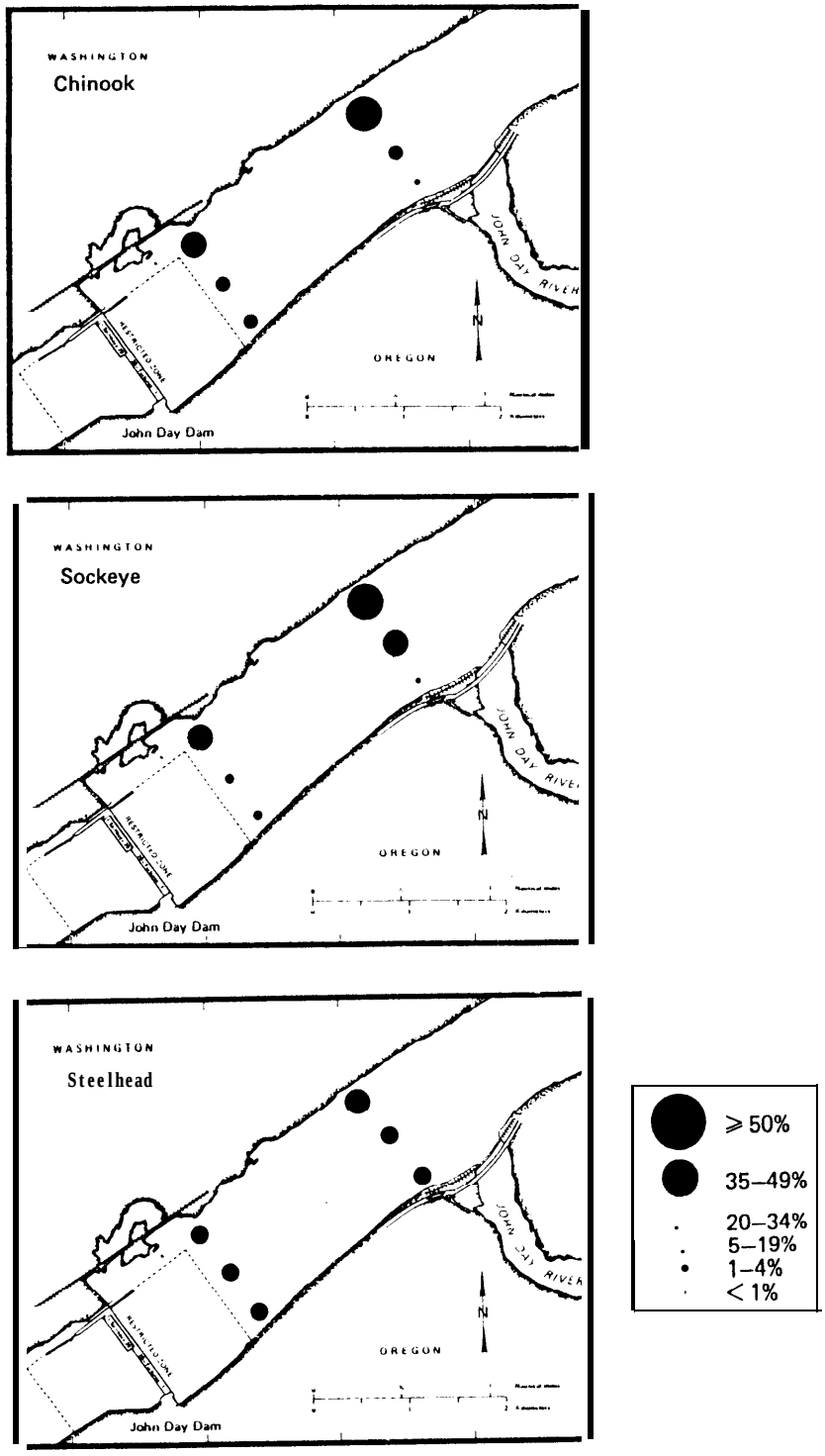


Figure 5.--"Mean distribution of juvenile salmonids for six dates (4-26, 4-28, 5-3, 5-19, 5-24, 5-26) during spring 1983.

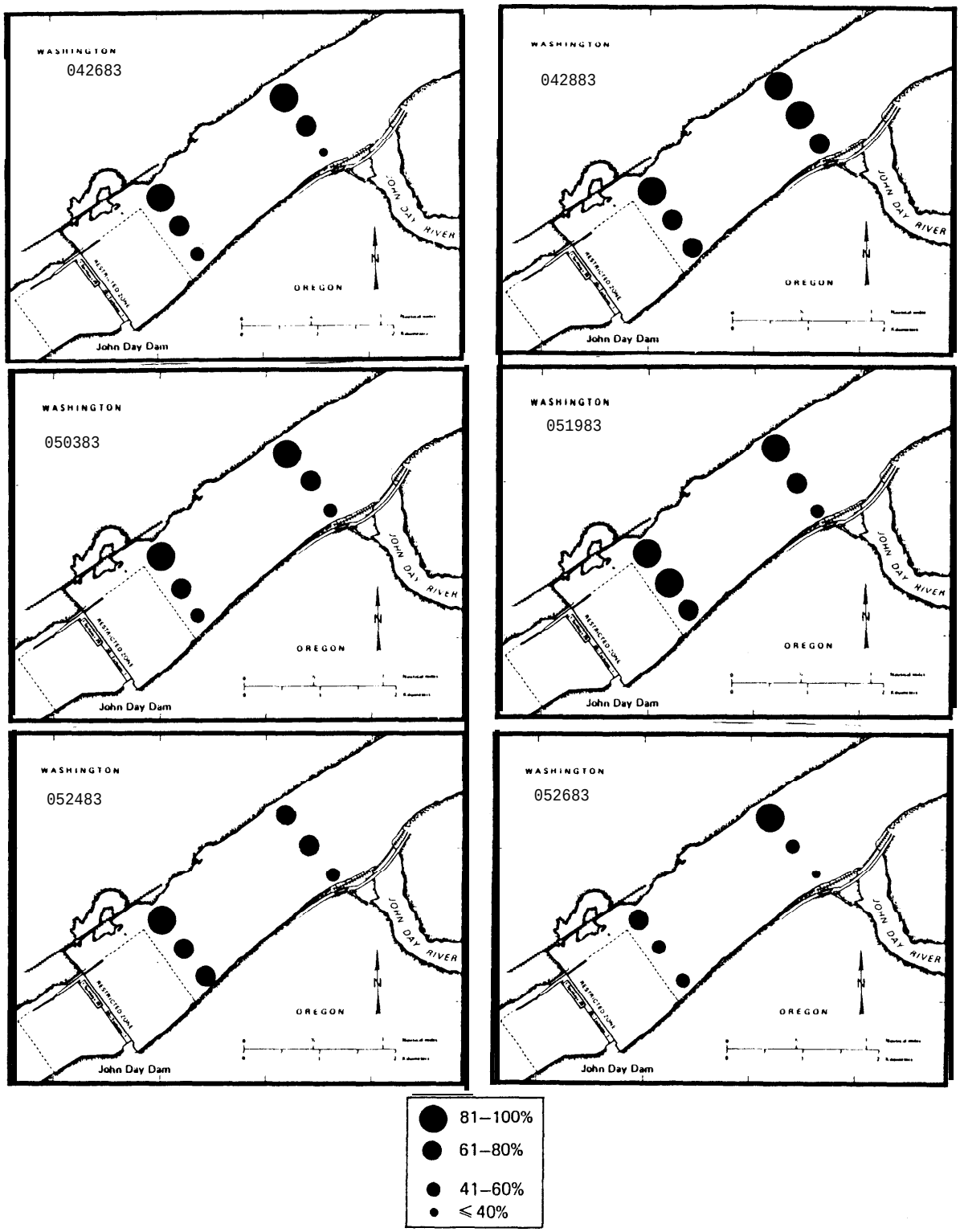


Figure 6.--Relative water visibility, expressed as a percentage of the maximum secchi disk reading each day.

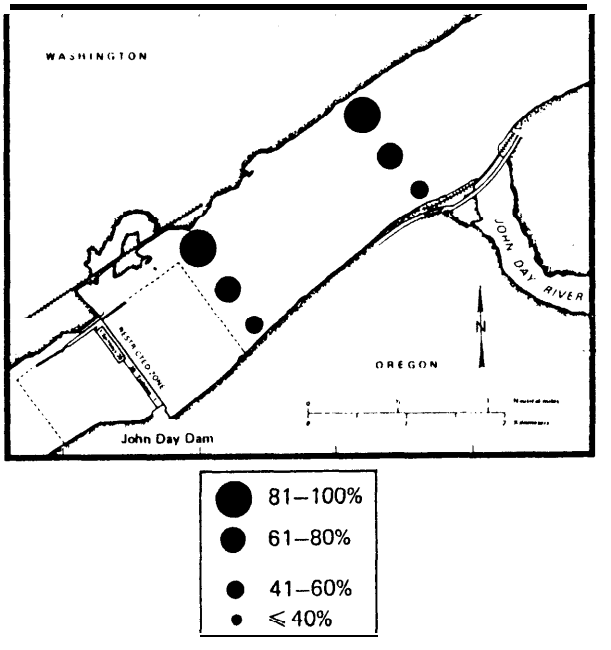


Figure 7.--Relative water visibility averaged over 6 sampling dates. Data are expressed as a percentage of the maximum daily secchi reading.

Flow-net Model

During the 5-month monitoring period, total river discharge ranged from 75 kcfs on 4 October to 427 kcfs on 31 May. Spill conditions varied considerably from April to October. Early in the spring when runoff was high (300-422 kcfs), spill gates were often open 24 h per day and discharge was typically 40 to 55% of the river flow; a maximum hourly level of 70% spill occurred on 28 July. Later in the summer, as runoff subsided, spill was provided primarily during night periods for fish passage.

Since we have just recently reached the point in our program development which permits depicting both the flow and current data graphically, no detailed analysis or discussion is available at this time. However, included in this report are some representative data illustrating the prevailing current patterns and dam operations for selected dates.

During the 7 h of purse seine sampling conducted on 26 April, both discharge levels at the dam and current patterns in the forebay remained relatively stable (Figures 8 and 9). Spillway water was discharged in a "crowning" pattern, and the hourly rate fluctuated from about 50 to 60%. In the forebay, the highest velocities, up to 33 cm/sec, were recorded at the mid-river and westerly-most stations within the restricted zone. The lowest velocities, near 5 cm/sec, were observed at the upstream stations along the Washington shore and at the downstream stations along the Oregon shore (Figures 8 and 9).

On 28 April, total river flow fluctuated from a low near 300 kcfs at mid-day to 360 kcfs later in the afternoon. Correspondingly, the current velocities at upstream sites were markedly lower and downstream sites somewhat lower at mid-day (Figure 10) than they were later in the afternoon

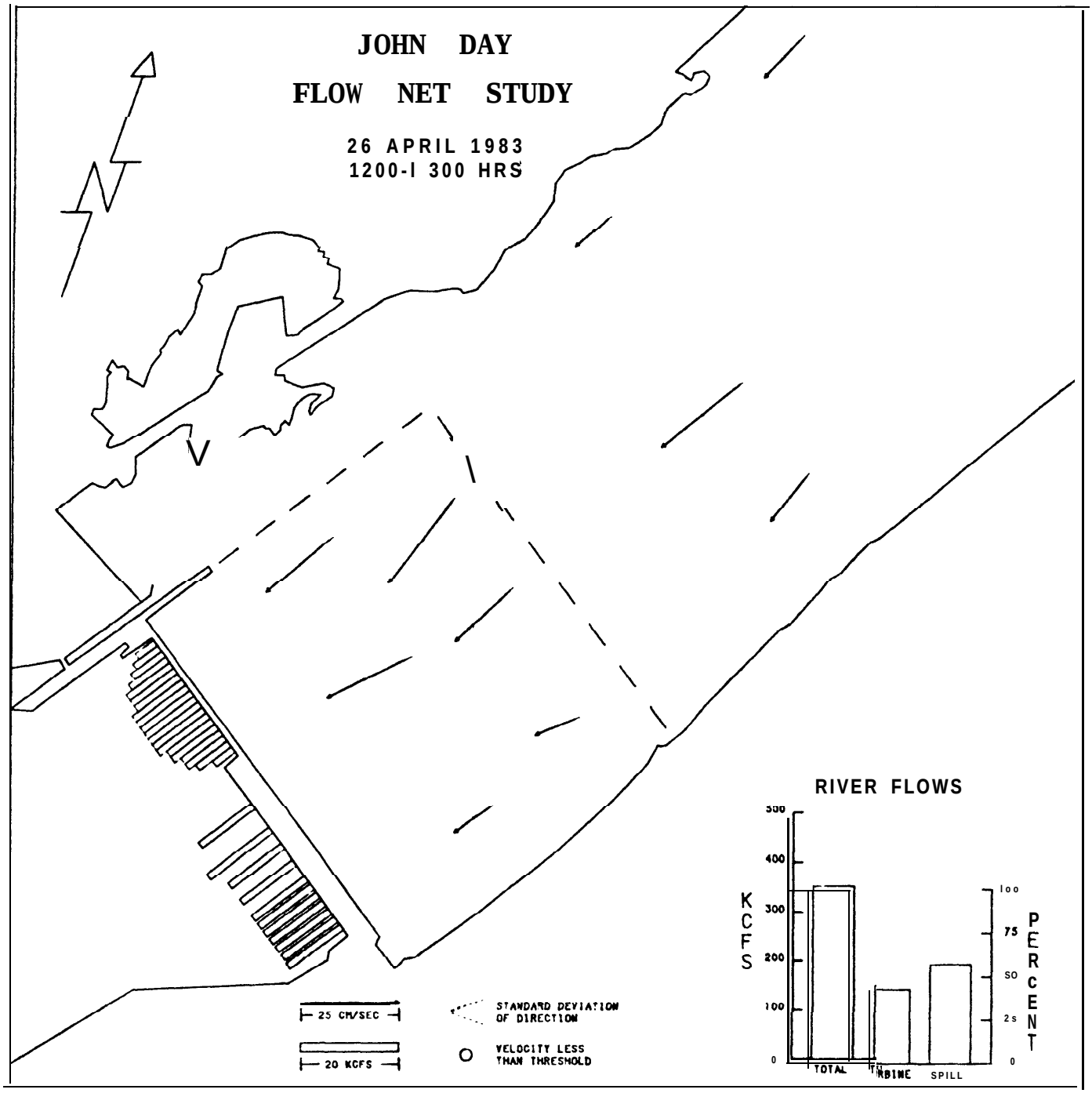


Figure 8.--Forebay current patterns and dam operations on 26 April 1983 (1200-1300).

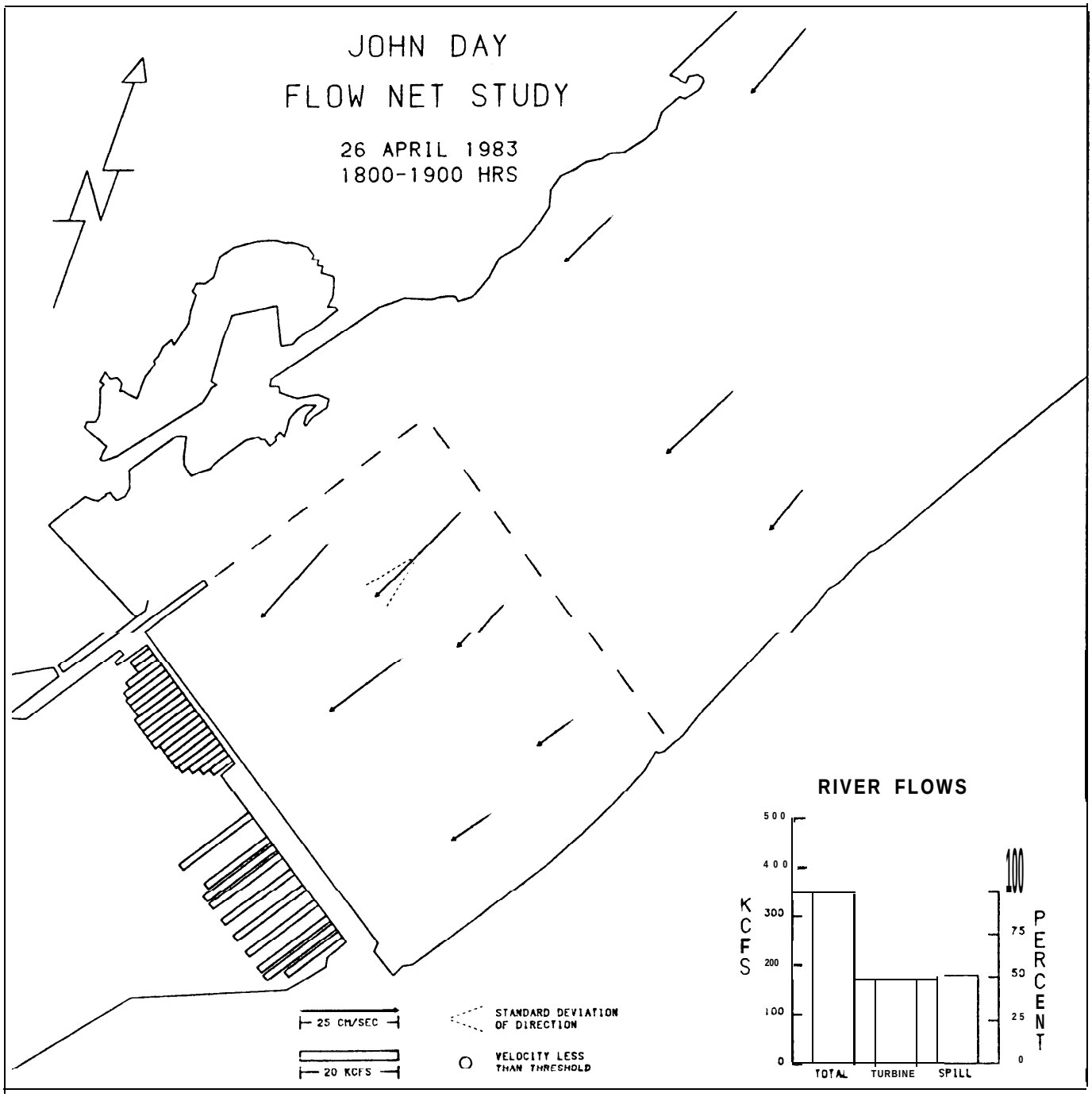


Figure 9.--Forebay current patterns and dam operations on 26 April 1983 (1800-1900).

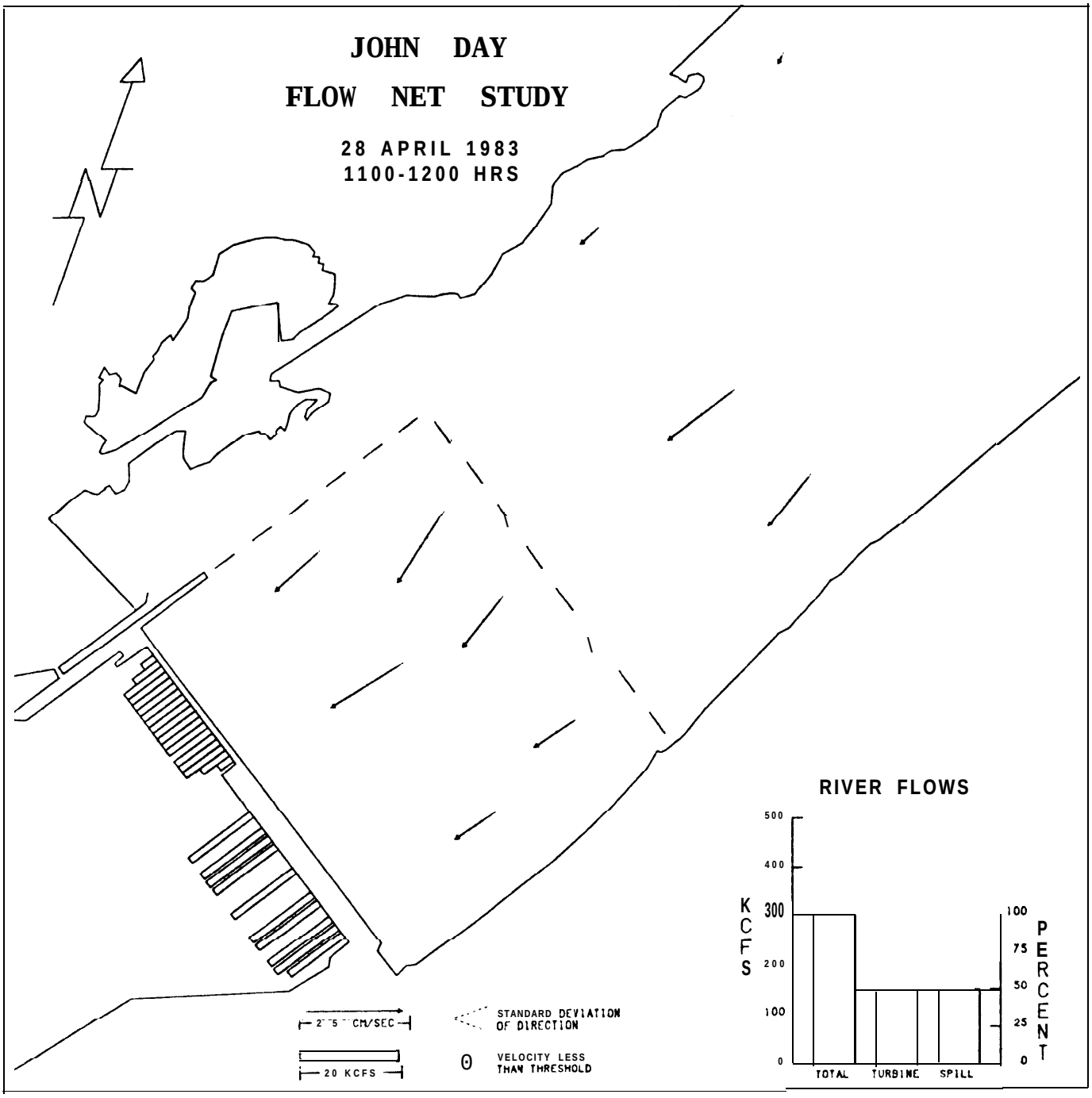


Figure lO.--Forebay current patterns and dam operations on 28 April 1983 (1000-1100).

(Figure 11). The proportion of water spilled remained a constant 50% during both periods. When the discharge volumes increased 60 kcfs between 1100 and 1700 h, the increase in spill and the addition of Turbine Unit 12 on-line tended to shift the direction of flow on some of the meters in the restricted zone toward the Washington (spill) side of the river. The flow net nearest the Oregon shore did not appear to be affected.

Again, the purpose of these data depicted herein is to illustrate the nature and elements of the cartographic model and generally what information it can reasonably be expected to provide; additional graphs are provided in Appendix B. Future reports will provide more extensive descriptions of the current patterns with respect to prevailing dam operations and river flow conditions and focus on the relationship between current patterns and Smolt migration routes.

RADIO TRACKING

Introduction

Juvenile salmonid passage locations at the Columbia River hydroelectric dams are affected by several physical factors in the forebays, but ultimately it is the reaction of the smolts to the physical factors that determines their passage location. Sampling techniques at the dam can provide estimates of the proportion of a population passing at any location as a factor is changed, but the migration route to a given location would remain unknown. In 1979, the NMFS developed a radio transmitter that was small enough for studying the behavior of smolting salmonids. During the 1980 thru 1982 Smolt outmigrations, the juvenile tag was used to study Smolt behavior in the John Day Dam forebay. From that work, behavior patterns have begun to develop.

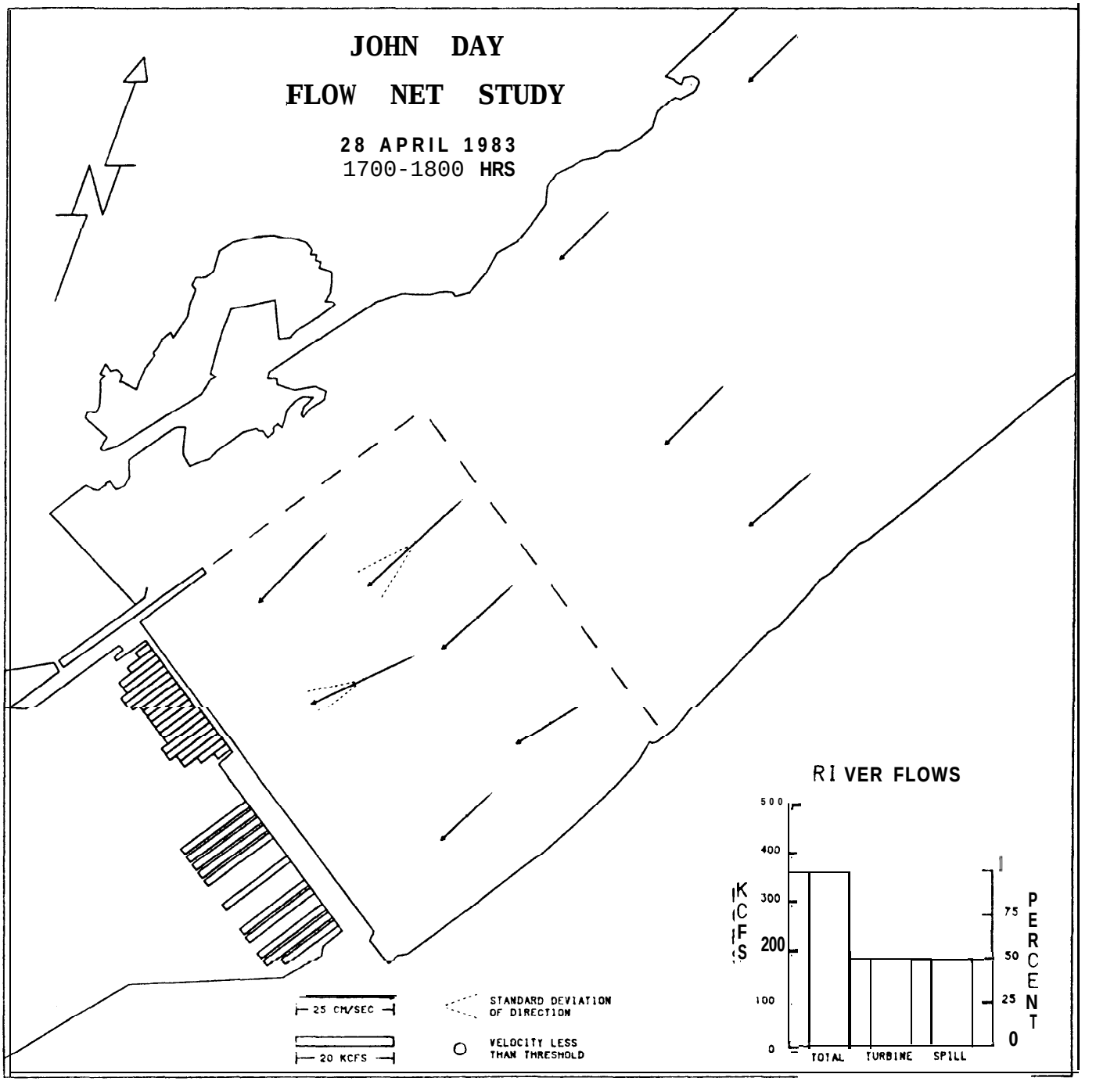


Figure 11.--Forebay current patterns and dam operations on 28 April 1983 (1600-1700).

From limited results in 1980, we found that most of the fish passed a position near the Washington shore, 3 km upstream from the dam, and while the reason for this behavior was not clear, the release site in 1981 and 1982 was moved to this area to increase the number of tracks that could be completed in one field season.

The behavior patterns of the fish as they moved downstream from the release area appeared to be related to the proportion of the river flow being passed through the spillway. With increased spill rates, proportionally greater numbers of radio tagged smolts remained on the spill side of the river and more fish passed through the spillway. Very few fish that crossed to the powerhouse side of the river ever recrossed the river and passed through the spillway.

The day vs night behavior of radio tagged smolts in the forebay supported the die1 sampling data taken at the dam. Radio tagged smolts held in the area between the dam and John Day River during daylight periods and passed through the dam after dark. The most prominent holding area was within 1 km of the dam.

As we continued radio tracking of salmonid smolts in 1983, there were four areas of concern. The first was to increase the number of replicate tracks during available flow condition. The second was to determine whether the release site was biasing the data by placing too many fish on the Washington side of the river. Holding areas were the third concern; specifically, how far upriver do the fish began to slow and hold, and how does the proportion of river flow being spilled affect the holding. The fourth area of concern was to correlate movements of radio tagged fish to metered flow measurements.

In 1983, the NMFS used radio telemetry to observe salmonid smolt behavior in the forebay of John Day Dam. The objectives were to: (1) expand on the knowledge of the effects of set modes of spill and powerhouse operation on chinook salmon smolts in the forebay of John Day Dam and (2) correlate behavior data of radio tracked smolts to metered flow data and distribution data obtained through purse seine sampling.

Methods and Materials

Study Area

Radio tagged juvenile salmonids were tracked in the immediate vicinity of John Day Dam--Columbia River Kilometers (RKm) 347 to 353 (Figure 1). In this area, the river is about 1 km wide, and a major tributary, the John Day River, enters on the Oregon side at RKm 351.

Smolts have three primary paths that they follow downstream through John Day Dam: the spillway, the turbines, or the bypass system. Flows through the John Day Dam project range from 130 to 450 kcfs during the spring outmigration, and involuntary spill begins when flow falls below about 300 kcfs. Other passage routes are via the navigation lock and the two fishladders.

The salmonid outmigration in the spring normally follows the peak flows from the snow melt, beginning in mid-April and ending in early June.

Equipment

The juvenile radio tag was developed by NMFS electronics personnel to provide a means of monitoring movements of individual salmonid smolts. The

radio tags are battery powered transmitters that operate on a carrier frequency of approximately 30 megahertz (MHz). The transmitter and batteries are coated with Humiseal and then a mixture of paraffin and beeswax to form a flattened cylinder 26 x 9 x 6 mm, which weighs approximately 2.9 g in air. A 127-mm long flexible whip antenna is attached to one end of the tag. For identification purposes, each tag transmitted on one of nine frequencies spaced 10 kilohertz (KHz) apart (30.17 through 30.25 MHz). Individual tags on each frequency were pulse coded to provide individual identification of each tag. Tracking range of the tag varied from 100 to 1000 m depending on the output of the tag and the depth of the fish. The pulse rate was two per second, and the tag life was a minimum of 3 days.

Two types of tracking receivers were used, one for mobile operations and the other as a stationary monitor. Smith-Root RF-40 receivers in conjunction with hand held directional loop antennas were used during mobile operations, and a combination of our search unit, a pulse decoder, and a digital printer were used with directional loop antennas at the fixed monitor locations. Two boats (7.3 and 6.3 m long) were used as tracking platforms.

Tagging

Juvenile fish were collected at John Day Dam from an airlift pump in the gatewell of Turbine Unit 3. The smolts were selected from the fish caught during the evening before they were released. Depending on availability, the fish may have been held in the fish marking facility for as long as 48 h before tagging (during the weekends that the airlift was

not operated). Most of the fish, though, were held less than 6 h before tagging.

The smolts selected for tagging were longer than 148 mm and showed a minimum amount of descaling. Before tagging, the fish were mildly anesthetized with MS-222. After the fish was measured, the tag was dipped in glycerin and inserted into the fish's stomach. The tag's flexible antenna extended out of the fish's mouth and trailed back along the side of the fish. The time required to tag and place the fish in the recovery tank was usually less than 30 s.

Tagging was conducted between 0700 and 0800 h, and tracking started between 1300 and 1800 h. The period between tagging and release provided a test of the tags reliability and allowed the fish to adjust to carrying the extra weight. In cases where the tag failed, another fish was tagged and the recovery time was shortened. After recovery, tagged fish were placed in a live well on the larger tracking boat, transported to the release site, released into the river, and tracking began. Chinook salmon were the primary species studied, but steelhead and coho salmon were used when chinook salmon were not available.

Release Sites

Radio tagged fish were released at five locations in the forebay of John Day Dam (Figure 12). The three primary sites were on a river transect 6.3 km upstream from the dam (Washington side, mid-river, and Oregon side). When poor weather conditions prevented tracking from the primary sites, the releases were moved downstream 3 km to the area across from the mouth of

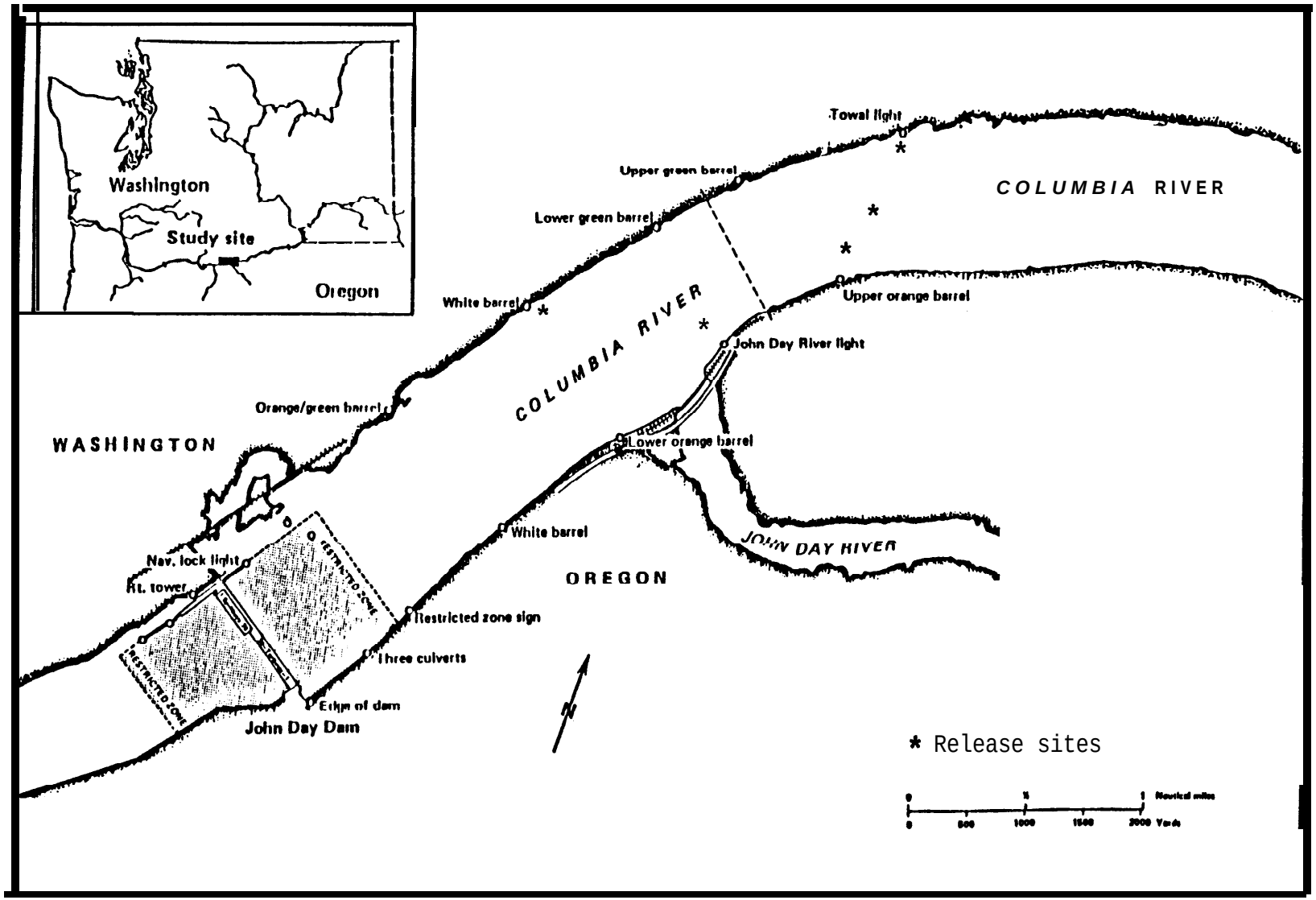


Figure 12.--Study area--radio tracking.

the John Day River that was used in 1981 and 1982. One release was made on the Oregon side of the Columbia River just upstream from the John Day River. Releases, as in previous years, were generally between 1300 and 1800 h to allow sufficient time for the fish to arrive at the dam by dusk.

Tracking

The limited tracking range and large size of the study area (6.3 km long by 1 km wide) required tracking be conducted from boats. Two boats, each with a two-man crew, were used for tracking the tagged fish. One person operated the boat while the second person operated the antenna and receiver. To maintain contact with the fish, one boat was deployed upstream from the fish, and the other boat was deployed to one side of the fish's expected location. As the relative position of the boats and fish changed, the boats would change positions, one at a time, in anticipation of the relative movement.

Because of the wind's influence on the boats and the short tracking ranges, constant cross bearings were needed to stay with the fish. If the signal was lost, the area was searched until the signal was relocated or for at least 1 h before the track was ended.

To obtain passage location at the dam for the fish lost during tracking and those left upstream because the fish were not moving, four fixed monitor units were placed on the upstream face of the dam. Two units divided the space occupied by the 16 active turbines and two monitors covered the 20 spill gates. The monitors were operational throughout the study, and the output was checked daily.

Data Collection and Analysis

Fixes for plotting the fish's location on tracking maps were made by placing a boat directly over the fish's location and then fixing the location of the boat on the map. The boat was judged to be directly over a fish when a strong signal was received throughout the entire 360" rotation of the antenna. The location of the boat was established by measuring, with a sextant, the horizontal angle between fixed navigational aids and or brightly colored and lighted markers placed at known positions on the river bank. The angles, when plotted with a three-arm protractor, provide a very accurate and fast method of locating fish position on a navigational chart (Dunlap and Schufeldt 1969).

RESULTS

From 22 April to 22 June, 34 juvenile salmonid smolts (21 chinook salmon, 11 steelhead, and 2 coho salmon) were radio tracked (Table 1). The mean length of the chinook salmon was 159 mm, steelhead 174 mm, and coho salmon 165 mm. Of the 34 fish, passage locations are known for 19.

River flows during the tracking periods ranged from 158.3 to 434.4 kcfs, with spill rates of up to 62% of total river flow. During the periods of radio tracking (218 h) the spill rates were greater then 34% of the river flow during 157 h and less than 2% during 48.h. The remaining hours (13) were scattered between spill rates of 2 to 34%. Illustrations of individual radio tracks are included in Appendix C.

In 1983, radio tracking was able to detect delaying or holding actions in three areas. Delay activity was defined as upstream movement, or no movement between fish location readings. The first holding area was along

Table 1. --1983 radio tracking summary.

TAG CODE	SPECIES	LENGTH (MM)	RELEASE[a/] ITE	MONTH	DAY	TIME	TRACK TIME	REASON END TRACK	PASSAGE LOCATION	DATE	TIME	FOREBAY TIME-H.	DISCHARGE(KCFS) AVERAGE TOTAL	SPILL	%SPILL	AT PASSAGE TIME TOTAL	SPILL	%SPILL
766	CHINOOK	170	B	4	22	1341	2.4	TAG FAILURE				2.4	189.5	0	0			
633	CHINOOK	150	A	4	23	1251	8.1	WEATHER	SPILL	4/26	1609	76.0	308.1	150.3	49	350.2	218.5	57
176	CHINOOK	148	A	4	24	1250	6.1	NO MOVEMENT				6.1	270.7	134.6	50			
677	CHINOOK	158	C	4	26	1347	6.8	PASSAGE	SPILL	4/26	2034	6.8	349.5	193.0	55	347.2	174.6	50
278	CHINOOK	160	B	4	27	1347	5.5	PASSAGE	SPILL	4/27	1917	5.5	349.2	191.9	55	355.5	176.0	50
977	CHINOOK	149	C	5	4	1343	7.5	PASSAGE	SPILL	5/4	2111	7.5	305.7	132.3	43	298.0	150.4	50
876	CHINOOK	155	A	5	6	1352	6.6	LOST	SPILL	5/8	0346	39.0	328.4	159.7	49	316.0	156.7	50
372	CHINOOK	150	A	5	7	1341	4.5	PASSAGE	SPILL	5/7	1811	4.5	337.4	135.5	55	341.9	162.0	47
735	CHINOOK	154	A	5	8	1344	1.1	WEATHER	SPILL	5/9	2000	31.0	317.1	141.2	45	329.6	166.0	50
364	CHINOOK	155	E	5	10	1630	5.5	PASSAGE	POWERHSE	5/10	2218	5.5	360.5	136.2	38	358.0	148.8	42
270	CHINOOK	165	B	5	11	1339	3.8	LOST				3.8	345.9	150.4	43			
515	CHINOOK	177	A	5	17	1516	4.0	LOST				4.0	207.9	27.0	13			
746	CHINOOK	162	D	5	18	1350	9.8	LOST				9.8	269.3	69.5	26			
474	CHINOOK	162	A	5	19	1412	5.5	SEAGULL				5.5	282.0	27.2	10			
127	CHINOOK	164	C	5	20	1348	7.7	UPSTREAM				7.7	270.3	58.4	22			
627	CHINOOK	174	B	5	21	1421	8.7	PASSAGE	SPILL	5/21	2303	8.7	258.8	123.1	48	242.1	127.4	52
267	COHO	152	A	5	22	1357	9.5	PASSAGE	POWERHSE	5/22	2330	9.5	297.0	145.8	49	242.3	139.9	58
928	COHO	179	C	5	23	1419	6.5	NO MOVEMENT	SPILL	5/24	0420	15.0	208.2	120.9	43	270.5	140.8	52
766	STEELHEAD	165	B	5	24	1438	4.9	NO MOVEMENT	SPILL	5/25	1734	28.0	315.0	130.0	41	366.5	150.1	41
144	CHINOOK	159	C	5	25	1342	7.3	LOST	SPILL	5/25	2329	7.3	337.4	146.8	44	353.8	180.5	51
547	STEELHEAD	175	B	6	2	1345	0	HIGH WIND										
133	STEELHEAD	165	B	6	3	1338	0	LOST										
667	STEELHEAD	189	A	6	5	1338	8.3	NO MOVEMENT	POWERHSE	6/7	0515	43.0	365.8	183.0	50	377.6	188.4	50
246	CHINOOK	180	A	6	6	1415	5.1	PASSAGE	POWERHSE	6/6	1920	5.1	374.1	183.1	49	372.1	177.3	48
575	STEELHEAD	175	C	6	7	1339	5.5	PASSAGE	POWERHSE	6/7	1910	5.5	350.2	153.6	44	347.3	150.2	43
728	STEELHEAD	172	B	6	8	1334	5.7	NO MOVEMENT				5.7	349.8	153.8	43			
146	STEELHEAD	177	A	6	9	1418	4.8	NO MOVEMENT				4.8	339.5	133.8	39			
363	CHINOOK	150	B	6	15	1714	0	HIGH WIND										
527	STEELHEAD	173	C	6	16	1425	6.1	NO MOVEMENT	POWERHSE	6/18	0503	40.0	281.1	66.7	24	244.3	55.7	23
126	CHINOOK	149	D	6	17	1426	1.1	WEATHER				1.1	275.6	0	0			
228	STEELHEAD	183	D	6	18	1344	2.3	WEATHER	SPILL	6/22	0022	84.0	242.8	46.0	19	241.1	118.7	49
867	CHINOOK	150	D	6	19	1339	7.6	UPSTREAM	SPILL	6/20	0032	12.0	237.2	51.0	22	222.9	110.9	50
327	STEELHEAD	187	D	6	20	1726	4.3	NO MOVEMENT				4.3	260.8	56.1	22			
170	STEELHEAD	173	B	6	22	1411	7.5	NO MOVEMENT				7.5	254.2	19.8	8			

[a/] RELEASE SITES
6.3 KM. TRANSECT
A-WASHINGTON SIDE
B-MID-RIVER
C-OREGON SIDE
ROUGH WATER RELEASE SITE
D-WASHINGTON SIDE 4KM UPSTREAM
PLUME TEST
E-OREGON SIDE INTO JDR WATER

the release line 6.3 km above the dam; the second at the upstream edge of the John Day River plume; and the third just upstream from the restricted zone line, 1 km above the dam (Figures 13 and 14). Steelhead delayed or held near the John Day River whereas chinook salmon exhibited delaying action throughout the study area. Some steelhead spent over 1 day in the study area (26.9-82.6 h) for an average of 46.9 h. Chinook salmon delays in the study area (9.8-75.3 h) were shorter than steelhead and averaged 32.8 h.

Migration patterns exhibited between the restricted zone line and the dam appear to be dependent upon the period of the day that a given fish entered the area. If the fish entered the restricted zone during the daytime (0800-2000 h), they tended to hold until dark before passing the dam. If they entered at night (2000-0700 h), the fish generally moved through the dam with little delay.

In 1983, 9 of the 11 chinook salmon released 6.3 km upstream and tracked at least to the vicinity of John Day River plume, either stayed close to or were tracked toward the Washington shore after release (tracks 633, 677, 278, 977, 876, 144, 127, 246, and 627 in Appendix C). Visual assessment of the position of the John Day River plume suggested that chinook salmon in particular may be avoiding the turbid water. Chinook salmon intercepting the plume near the middle of the reservoir typically follow its demarcation line toward the Washington shore.

Based on the limited number of tracks available, it appears that steelhead are not affected by the John Day River plume to the same extent as chinook salmon. Two of the steelhead were in the heart of the plume on the Oregon side of the river after passing the John Day River (tracks 766

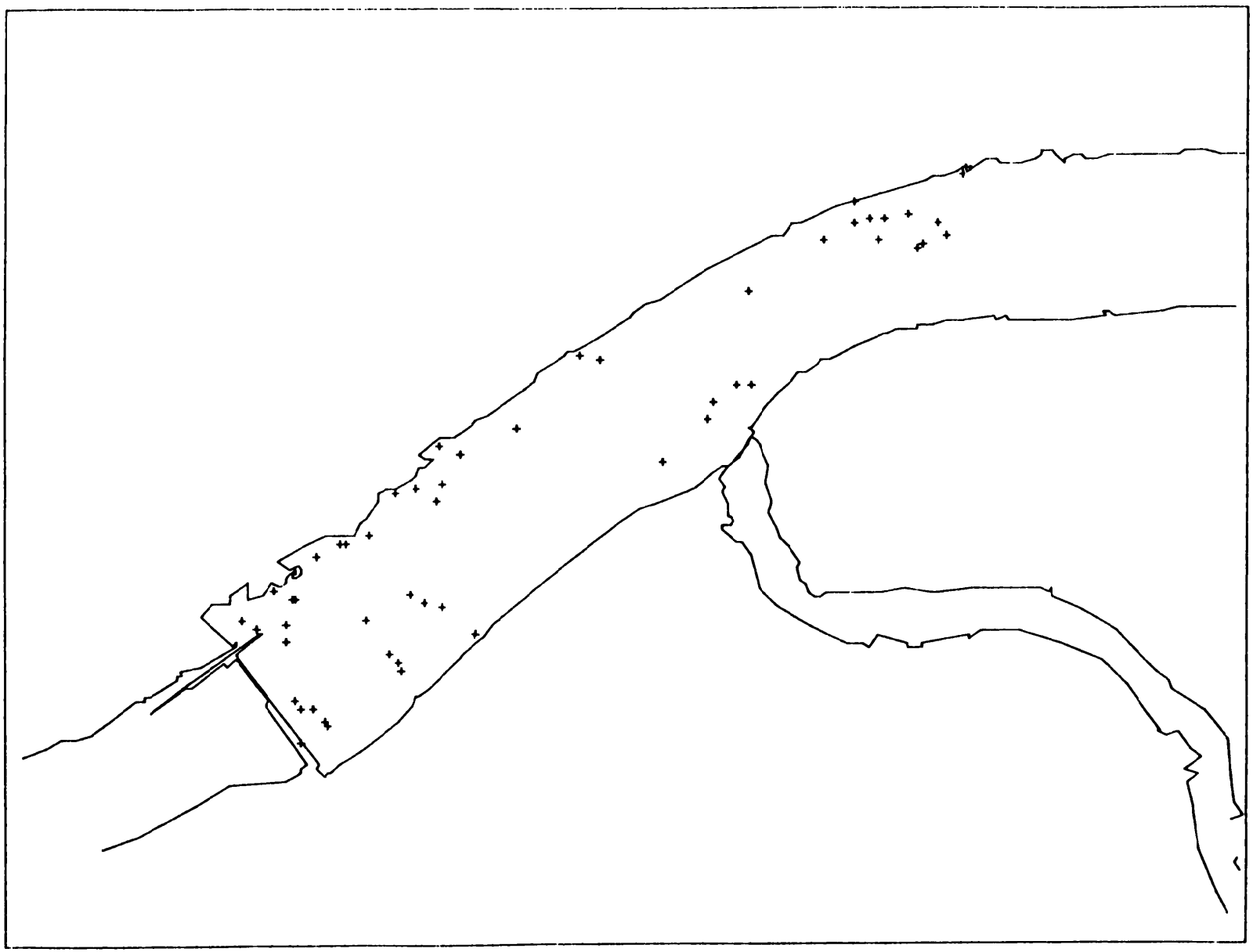


Figure 13.--Locations where chinook salmon either delayed or moved upstream during the 1983 juvenile tracking study.

Figure 14.--Locations where steelhead either delayed or moved upstream during the 1983 juvenile tracking study.

and 728, Appendix C). This behavior generally agreed with the distribution determined from purse seining (discussed previously).

In 1983, 13 of the radio tagged smolts (all species) passed through the spillway and 6 through the powerhouse. These passages were added to the previous 1980-82 data base to form Table 2. As can be seen, there is no question that passage through the spill increases with increased volume of water through the spillway. Based on these limited data (54 passages over a 4-year period), it would also appear that passage rates through the spillway (all species) were higher than the portion of river being spilled.

When passages of tagged fish through the spillway and powerhouse in 1983 were split out by species, there appeared to be a relationship with the behavioral differences of the two species with respect to the John Day River plume that resulted in higher spill passage of chinook salmon. Ten of the chinook salmon passed through the spillway and one through the powerhouse for 90% plus spill passage with spills averaging 50%. In contrast, only two steelhead passed through the spillway and three through the powerhouse for 40% spill passage with spills averaging 41%. The avoidance of turbid water by the chinook salmon may be a major factor in their higher spill passage percentage than the percentage of volume of water being spilled. As indicated by radio tracking and the purse seine catches in 1983, these fish, to avoid the turbid water, are being shunted over to the Washington (spill) side of the river where they would be more susceptible to spill passage. The same data showed that steelhead, on the other hand, did not appear to be affected by the plume, and, as noted, their rate of passage through the spillway was more in line with the proportion of water being spilled.

Table 2.--Passage location and the existing spill rate for all of the radio tagged salmonid smolts passing John Day Dam, 1980-1983.

% of river flow being spilled	Passage location of tagged fish			
	Powerhouse		Spill	
	number	%	number	%
0-20	3	100	0	0
21-33	8 (1)	53	7	47
34-45	9 (2)	50	9 (1)	50
≥ 46	4 (3)	22	14 (12)	78
Total	24		30	

( ) 1983 tracks

Over 80% (43 of 54) of the spillway and powerhouse passages tracked over the past 4 years were chinook salmon. Thus passage locations shown in Table 2 were primarily those of chinook salmon. If during 1980-82 there was comparable turbid water and the reactions of the chinook salmon to that plume, were the same as i.n 1983, it would easily explain the higher spill passage than proportion of water being spilled that is indicated in Table 2.

Because of the limited data base used for the above analysis, though, no conclusions should be made on results at this time. There are a variety of other factors affecting passage location, including spill conditions, fish holding patterns, time of movement through the restricted zone limnological conditions, prevailing wind, water velocity patterns, etc., that have not all been correlated with the radio tracking data. Now that the bulk of the computer programs necessary to process the current meter information are operational, that part of the data can be effectively assessed. Studies planned for 1984 will address remaining variables.

SUMMARY

During 1983, the research program had three separate but complementary phases--defining fish distribution with purse seine sampling, monitoring current patterns in the forebay, and describing the migration routes of salmonid smolts using radio tracking techniques. Although data analysis is not complete at this time, a number of preliminary qualified observations were reported and summarized as follows:

1. Both purse seine and radio tracking data demonstrate that chinook salmon tend to migrate downstream and congregate on the Washington shore of

the Columbia River whereas steelhead are more evenly distributed throughout the reservoir. Turbidity measurements suggest that chinook salmon may be avoiding the turbid John Day River plume. Sockeye salmon are distributed in the same fashion as chinook salmon.

2. Preliminary current pattern and dam operations data are displayed graphically. Changes in current patterns due to fluctuations in dam operations are apparent. Extensive analyses are forthcoming.

3. Migration patterns exhibited between the restricted zone line and the dam appear to be dependent upon the period of the day that a given fish entered the area. If the fish entered the restricted zone during the daytime (0800-2000 h), they tended to hold until dark before passing the dam. If entering at night (2000-0700 h), the fish generally moved through the dam with little delay.

4. Radio-tagged chinook salmon approaching the dam at night passed through the spillway at a higher rate than the portion of the river flow being spilled in 1983. This situation may be related more to the concentrating of these fish in front of the spillway by the John Day River plume than to the percent of water being spilled. Spill passage for steelhead, not influenced by the plume, closely approximated the percent of water being spilled.

5. Because of the limited data base used for the passage patterns addressed in Summary Item 3, no conclusion should be made based on the results at this time. Such factors as fish holding patterns, time of movement through the restricted zone, limnological conditions, and flow-net have not all been correlated with the radio tracking data.

RECOMMENDATIONS

Originally, the objective of this study was to define the flow-net in the forebay of John Day Dam and relate Smolt passage behavior to the prevailing current patterns, a seemingly straight forward endeavor. However, the 1983 fish distribution and radio tracking data suggest a more complex situation which requires the focus of the program be expanded to determine which physical characteristics, e.g., flow-net, John Day River discharge, or some other as yet unidentified factor, either separately or in concert, affect the migration routes and ultimate passage location of salmonid smolts and to assess the effect of dam operations on these parameters.

To meet this objective, we propose the following activities during FY84:

1. The current system in John Day Reservoir will continue to be monitored with self-contained magnetic recording current meters, and the cartographic flownet model will be finalized. Specific dam operation conditions may be requested if they are necessary to complete the analysis.

2. Fish distribution within the study area will be defined using the purse seining program. Transects will be established upstream from and within the zone of John Day River discharge and continue downstream toward the dam. Sampling will be conducted for 4 to 6 weeks near the peak of the migration.

3. Water turbidity, temperature, velocity, and direction will be measured at the purse seining sites to provide indices of the influence of the John Day River plume on the passage behavior of juvenile salmonids.

Preliminary data in FY83, as well as data presented by Damkaer (1983), suggests that turbidity and temperature are useful physical factors which can be used to delineate the area in the Columbia River influenced by the plume.

4. Several lots of radio tagged fish, each consisting of 15-30 individuals, will be released into the Columbia River 6.3 miles upstream from the dam (above the mouth of the John Day River). An array of eight monitors fixed on the dam will record both the time and position of passage for individual fish. This should afford the ability to correlate fish passage with a variety of physical factors in the forebay, and statistically test the significance of the relationships. The releases will be executed within the 4- to 6-week period near the peak of the migration when the purse seining is occurring.

Other aspects that could be investigated include an evaluation of the holding behavior in and near the restricted zone; an assessment of the effects of meterological events, specifically wind speed and direction; and the influence of fluoride concentrations (Damkaer 1983) on smolt movement.

ACKNOWLEDGEMENT

Support for this research came from the region's electrical ratepayers through the Bonneville Power Administration.

SUMMARY OF EXPENDITURES FY 1983

Category:	Amount ($ x 10^3):
Salaries	75.3
Transport	2.8
Travel	4.2
Contract Services	4.8
Supplies and Materials	19.1
Equipment	0.5
Support (NOAA, DOC, SLUC)	34.4
Total	141.0

LITERATURE CITED

Bell, M. C., A. C. Delacey, and H. D. Copp.
1972. A compendium on the survival of fish passing through spillways and conduits. Fishery Engineeering Research Program, U.S. Army Corps of Engineers, North Pacific Division, Portland, Oregon.

Damkaer, D. M.
1983. Effects of waterborn pollutants on fish-passage at John Day Dam, Columbia River. Northwest and Alaska Fisheries Center Processed Report. 77 p.

Dunlap, B. C. and H. H. Schufeldt.
1969. Dutton's navigation and piloting. United States Naval Institute, Annapolis, Maryland. 691 p.

Faurot, D. A., L. C. Stuehrenberg, and C. W. Sims.
1982. Migrational characteristics of juvenile salmon and steelhead trout in the Columbia River System, 1981. Northwest and Alaska Fisheries Center, Natl Mar. Fish. Serv., Seattle, Washington. 23 p.

Long, C. W., R. W. Krcma, and F. J. Ossiander.
1968. Research on fingerling mortality in Kaplan turbines. Northwest and Alaska Fisheries Center, Natl. Mar. Fish. Serv., Seattle, Washington.

McConnell, R. J. and W. D. Muir.
1982. Preliminary evaluation of the Bonneville Juvenile Bypass System--second powerhouse. Northwest and Alaska Fisheries Center, Natl. Mar. Fish. Serv., Seattle, Washington. 8 p.

Sims, C. W. and R. C. Johnsen.
1977. Evaluation of the fingerling bypass system at John Day Dam and the fingerling bypass system outfall at McNary Dam. Northwest and Alaska Fisheries Center, Natl. Mar. Fish. Serv., Seattle, Washington. 3 p. plus Appendixes.

Sims, C. W., J. C. Williams, D. A. Faurot, R. C. Johnsen, and D. A. Brege.
1981. Migrational characteristics of juvenile salmon and steelhead in the Columbia River Basin and related passage research at John Day Dam. Vol. I and II. Northwest and Alaska Fisheries Center, Natl. Mar. Fish. Serv., Seattle, Washington. 61 p.

Sims, C. W., R. C. Johnsen, and D. W. Brege.
1982. Migrational characteristics of juvenile salmon and steelhead trout in the Columbia River System - 1981. Vol I, Assessment of the 1981 Smolt migration. Northwest and Alaska Fisheries Center, Natl. Mar. Fish. Serv., Seattle, Washington. 16 p plus Appendixes.

Swan, G. A., R. F. Krcma, and F. J. Ossiander.
1983. Studies to improve fish guiding efficiency of traveling screens at Lower Granite Dam. Northwest and Alaska Fisheries Center, Natl. Mar. Fish. Serv., Seattle, Washington. 20 p plus Appendixes.

APPENDIX A

Fish Distribution and Limnological Data--Spring 1983

Table Al.--Purse seine and limnologlcal data--Spring 1983

Date	Sample station	Time	# of fish in each set					Mean Secchi reading (cm)	Temp (°C)
			Chinook 1	Coho	Sockeye	Steelhead	Chinook 0		
042083	8	1300	1	0	0	3	0	–	10
"	9	1400	12	0	0	6	0	–	10
"	7	1500	9	1	0	4	0	–	10
"	1	1730	3	0	1	2	1	–	10
"	3	1830	4	0	0	1	0		10
042683	1	1230	68	3	10	44	0	117	11
"	2	1350	77	4	9	35	0	86	–
"	3	1500	1	0	0	6	0	46	12
"	6	1600	2	0	1	22	0	46	–
"	9	1700	2	0	0	6	0	56	–
"	8	1800	16	0	0	5	0	76	–
"	7	1900	52	1	5	3	1	97	–
042783	1	1300	40	0	3	34	0	119	12
"	2	1400	137	10	19	83	0	86	–
"	3	1515	2	0	0	1	0	48	13
"	5	1620	14	1	1	13	0	46	–
"	9	1700	15	1	0	22	0	61	–
"	8	1800	12	0	0	13	0	84	–
042883	1	1245	35	0	3	11	0	91	12
"	2	1350	14	2	5	8	0	81	–
"	3	1500	2	0	0	5	0	66	14
"	4	1600	41	0	5	8	0	104	–
"	9	1700	24	0	2	19	0	69	–
"	8	1800	24	0	1	13	0	64	–
"	7	1900	106	5	5	15	0	98	–
050283	1	1230	73	0	19	139	0	107	13
"	2	1340	93	0	27	179	0	94	–
"	3	1500	4	0	0	16	0	46	14
050383	1	1230	283	1	244	65	0	102	13
"	2	1310	244	2	147	53	0	69	–
"	3	1520	3	0	0	10	3	46	14
"	5	1605	33	0	11	53	0	58	–
"	9	1700	37	0	25	67	0	56	
"	8	1800	78	0	19	69	0	64	
"	7	1900	129	0	184	13	0	91	

Table A1.--cont.

Date	Sample station	Time	# of fish in each set					Mean Secchi reading (cm)	Temp (°C)
			Chinook 1	Coho	Sockeye	Steelhead	Chinook 0		
050483	1	1330	182	0	55	32	0	**97**	13
"	2	1445	32	0	5	83	0	47	
"	3	1540	3	0	2	11	0	42	–
"	9	1700	10	0	5	22	0	57	–
"	8	1800	65	0	20	47	0	92	–
051083	5	1230	93	0	23	67	0	86	–
"	9	1340	57	0	14	37	0	75	
"	8	1440	118	0	99	27	0	88	15
051183	2	1500	59	0	14	9	0	108	–
"	3	1600	37	0	19	32	0	99	–
"	9	1700	45	0	5	45	2	86	
051983	1	1230	39	19	31	12	0	105	15
"	2	1340	55	23	50	37	0	91	
"	3	1455	3	0	0	4	0	65	16
"	5	1545	16	6	4	43	0	114	15
"	9	1550	26	14	7	19	0	89	–
"	8	1800	56	26	10	67	0	122	–
"	7	1900	53	21	76	48	0	128	–
052483	1	14 10	289	37	339	138	0	69	–
"	2	1530	12	1	15	9	0	56	
"	3	1630	0	0	1	3	1	43	17
"	9	1715	16	9	4	26	0	63	16
"	8	1800	64	5	9	33	0	73	
"	7	1900	86	1	59	54	0	93	16
052583	1	1225	61	2	97	4	0	71	16
"	3	1335	2	0	3	11	0	45	18
"	9	1430	9	3	2	102	0	68	16
"	7	1545	51	5	63	26	0	98	
052683	1	1240	109	16	183	79	0	120	16
"	2	1400	14	3	11	31	0	53	17
"	3	1450	0	0	1	23	0	46	18
"	4	1550	14	4	19	21	0	64	16
"	9	1700	4	0	2	33	0	61	17
"	8	1810	8	0	5	19	0	65	
"	7	1905	26	0	62	48	0	95	16
	Tot al		3,404	226	2,042	2,348	8		

Table A2. --Distribution of salmonid smolts in the forebay of John Day Dam--spring 1983. Sets were made between the hours of 1200-1900.

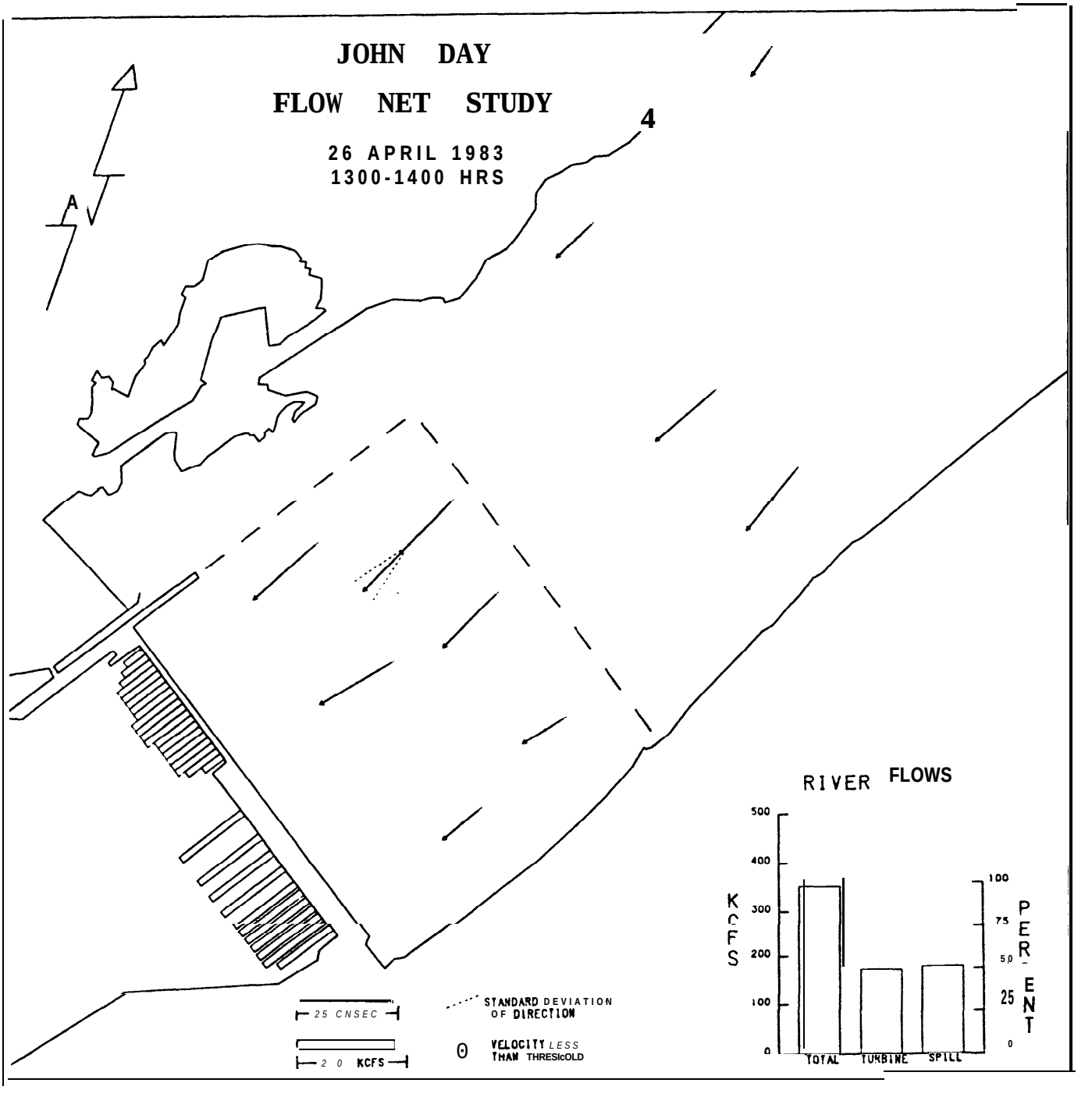
	Date	# of fish and % of total daily catch in parentheses, at station # 1	2	3	7	8	9	Total
Yearling Chinook								
	042683	68 (31)	77 (36)	1 (0.5)	52 (24)	16 (7)	2 (1)	216
	04 28 83	35 (17)	14 (7)	2 (1)	106 (52)	24 (12)	24 (12)	205
	050383	283 (37)	244 (32)	3 (0.4)	129 (17)	78 (10)	37 (5)	774
	051983	39 (17)	55 (24)	3 (1)	53 (23)	56 (24)	26 (11)	232
	052483	289 (62)	12 (3)	0 (0)	86 (18)	64 (14)	16 (3)	467
	052683	109 (68)	14 (9)	0 (0)	26 (16)	8 (5)	4 (2)	161
	X =	(39)	(19)	(095)	(25)	(12)	(6)	
Steelhead								
	042683	44 (44)	35 (35)	6 (6)	3 (3)	5 (5)	6 (6)	99
	042883	11 (15)	8 (11)	5 (7)	15 (21)	13 (18)	19 (27)	71
	050383	65 (23)	53 (19)	10 (3)	13 (5)	69 (25)	67 (24)	277
	051983	12 (6)	37 (20)	4 (2)	48 (26)	67 (36)	19 (10)	187
	052483	138 (52)	9 (3)	3 (1)	54 (21)	33 (13)	26 (10)	263
	052683	79 (34)	31 (13)	23 (10)	48 (21)	19 (8)	33 (14)	233
	x =	(29)	(17)	(5)	(16)	(18)	(15)	
Sockeye								
	042683	10 (42)	9 (38)	0 (0)	5 (21)	0 (0)	0 (0)	24
	042883	3 (19)	5 (31)	0 (0)	5 (31)	1 (6)	2 (13)	16
	050383	244 (39)	147 (24)	0 (0)	184 (30)	19 (3)	25 (4)	619
	051983	31 (18)	50 (29)	0 (0)	76 (44)	10 (6)	7 (4)	174
	052483	339 (79)	15 (4)	1 (0.2)	59 (14)	9 (2)	4 (1)	427
	052683	183 (69)	11 (4)	1 (0.3)	62 (23)	5 (2)	2 (1)	264
	X =	(44)	(22)	(0)	(27)	(3)	(4)	

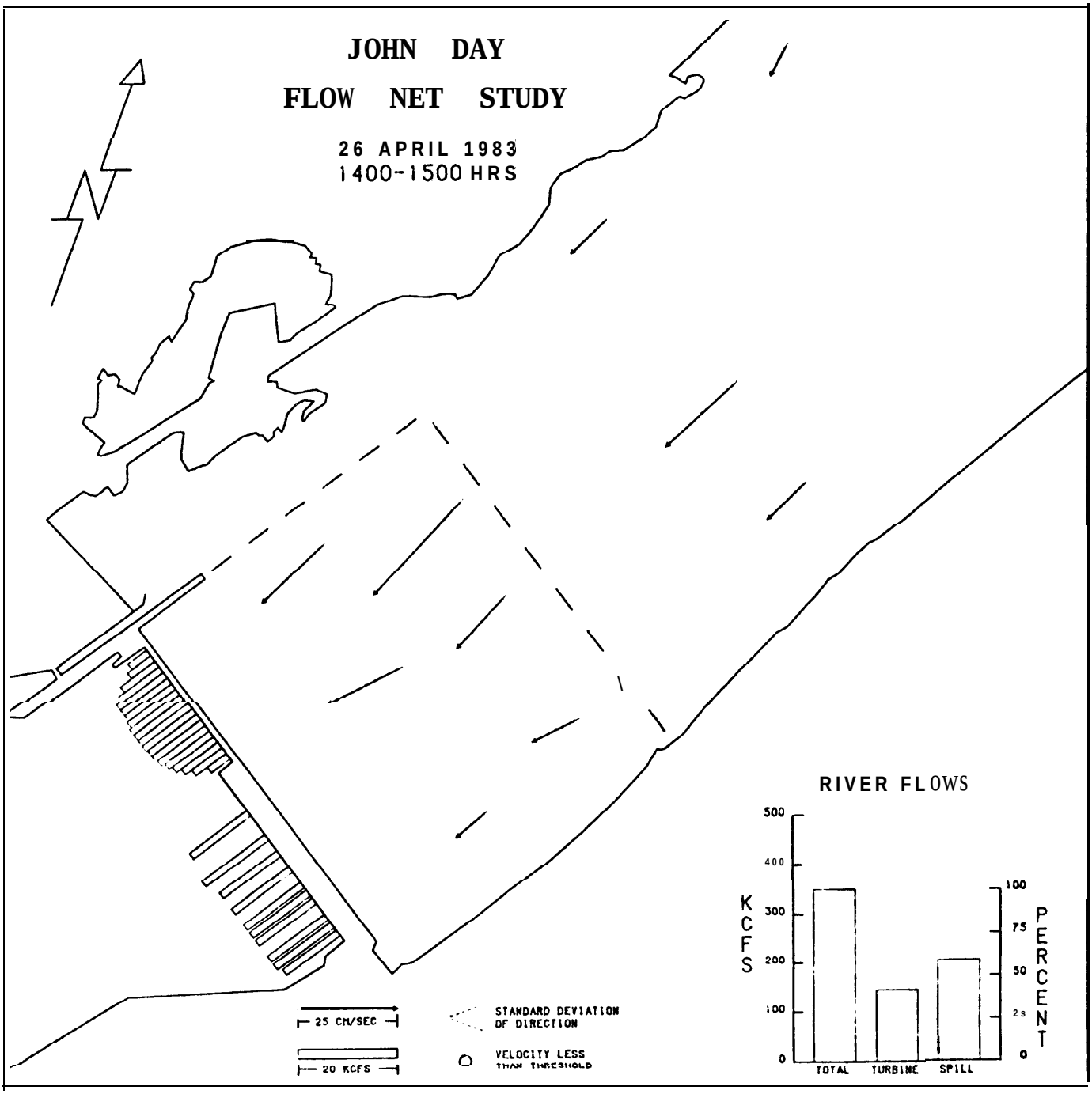
Table A3.--Secchi disk data at purse seine stations - spring 1983.

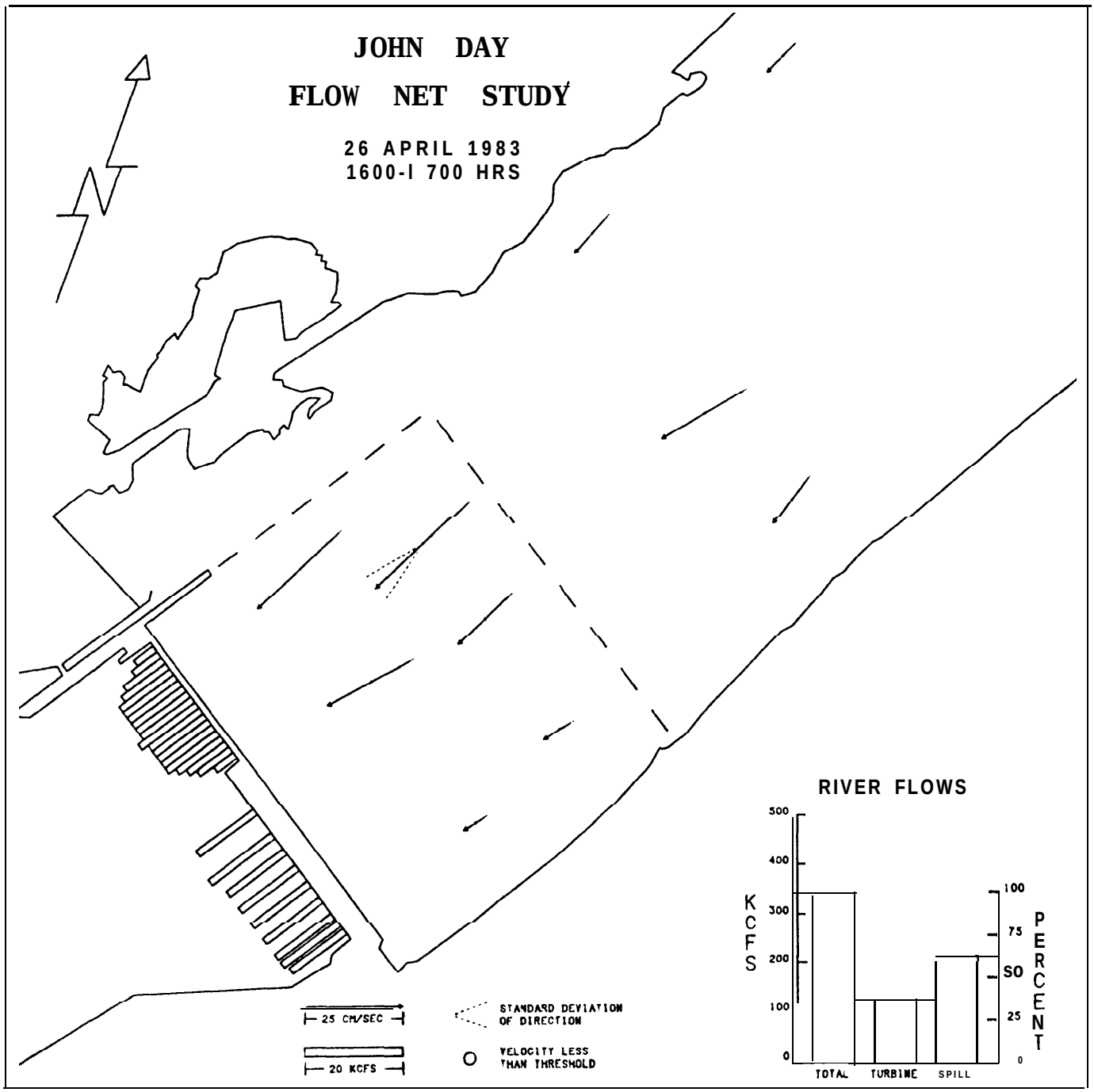
Date	Max. secchi reading (cm)	% of maximum daily reading @ station % 1	2	3	7	8	9
042683	117	100	74	39	83	65	48
042883	98	93	83	67	100	65	70
050383	102	100	68	45	89	63	55
051983	128	82	71	51	100	95	70
052483	93	74	60	46	100	78	68
052683	120	100	44	38	79	54	51
$\bar{x}$=		92	67	48	92	70	60

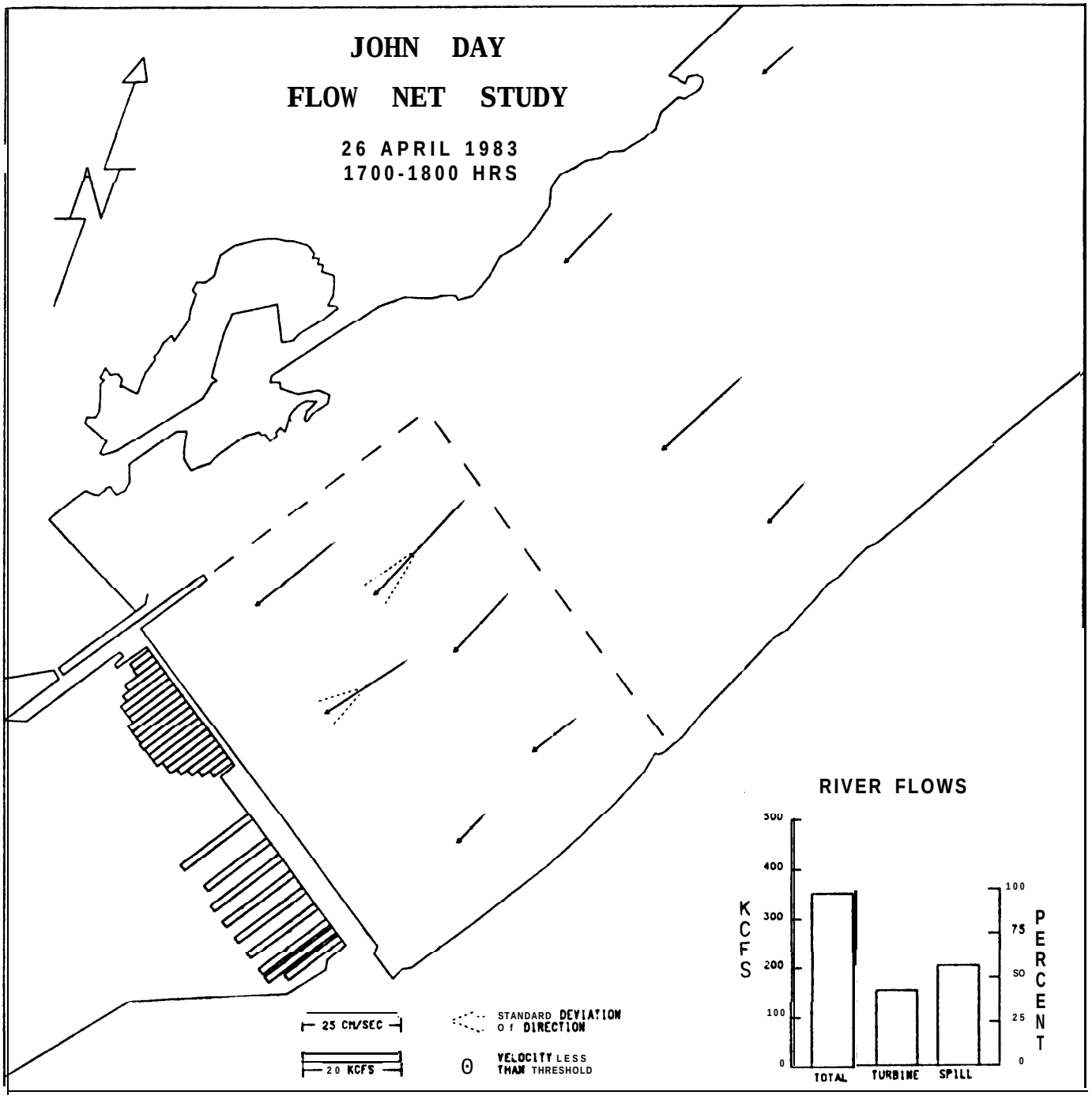
APPENDIX B

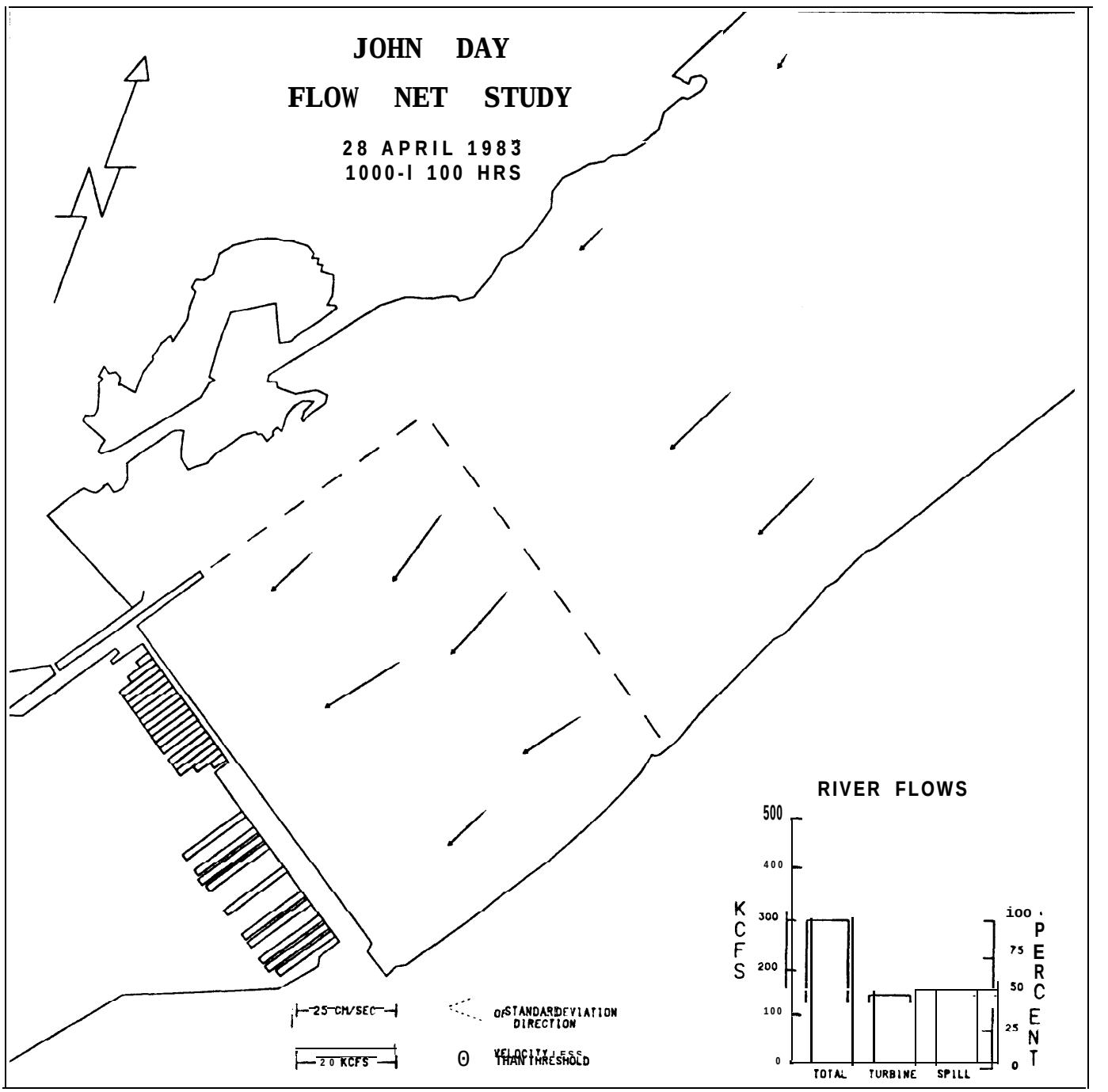
Examples of Forebay Current Pattern and Dam Operation Data--Spring 1983

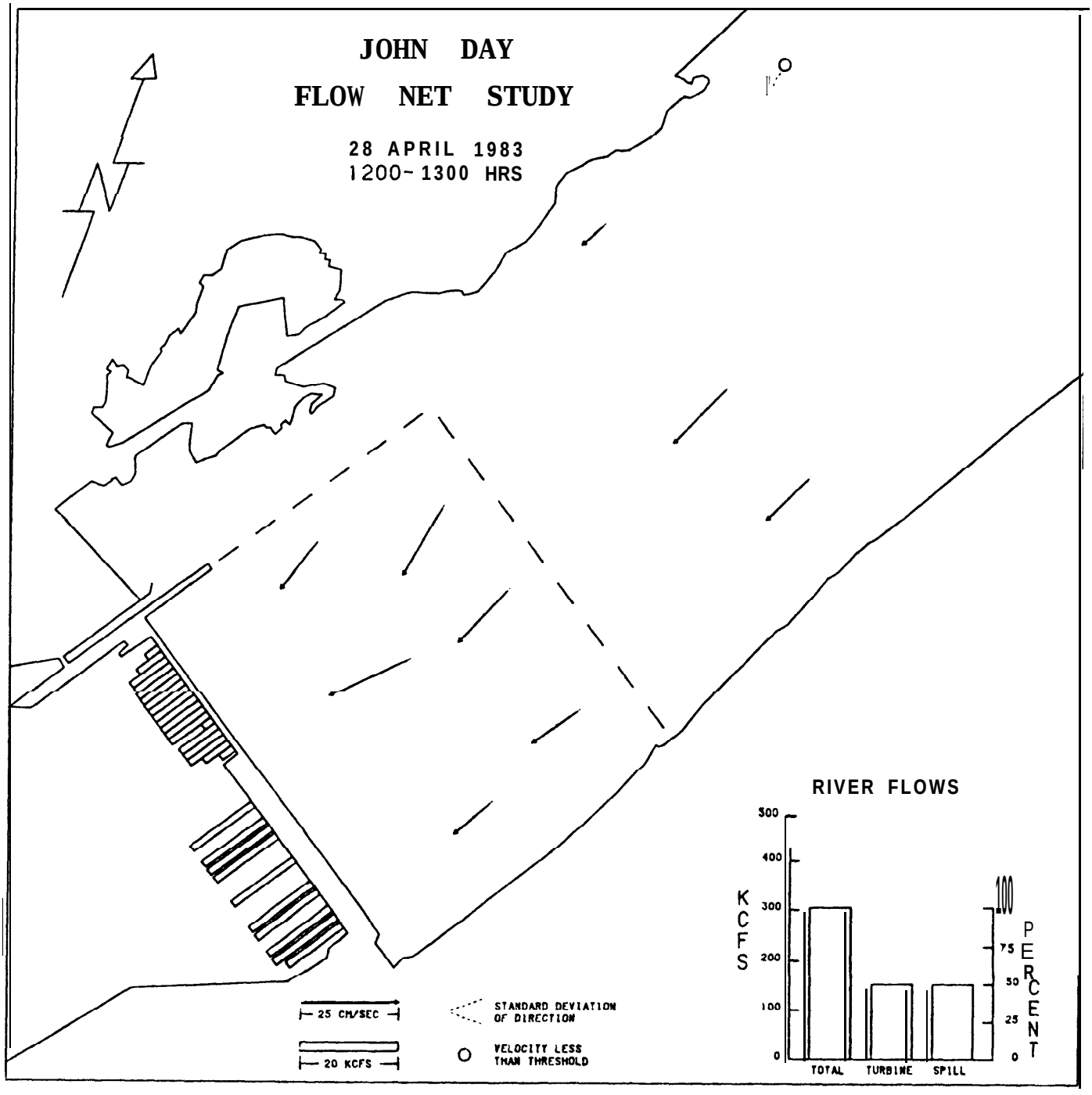

JOHN DAY
FLOW NET STUDY
26 APRIL 1983
1300-1400 HRS
4
A
25 CNSEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
VELOCITY LESS THAN THRESHOLD
RIVER FLOWS
KCFS
PERCENT
500
400
300
200
100
0
100
75
50
25
0
TOTAL
TURBINE
SPILL

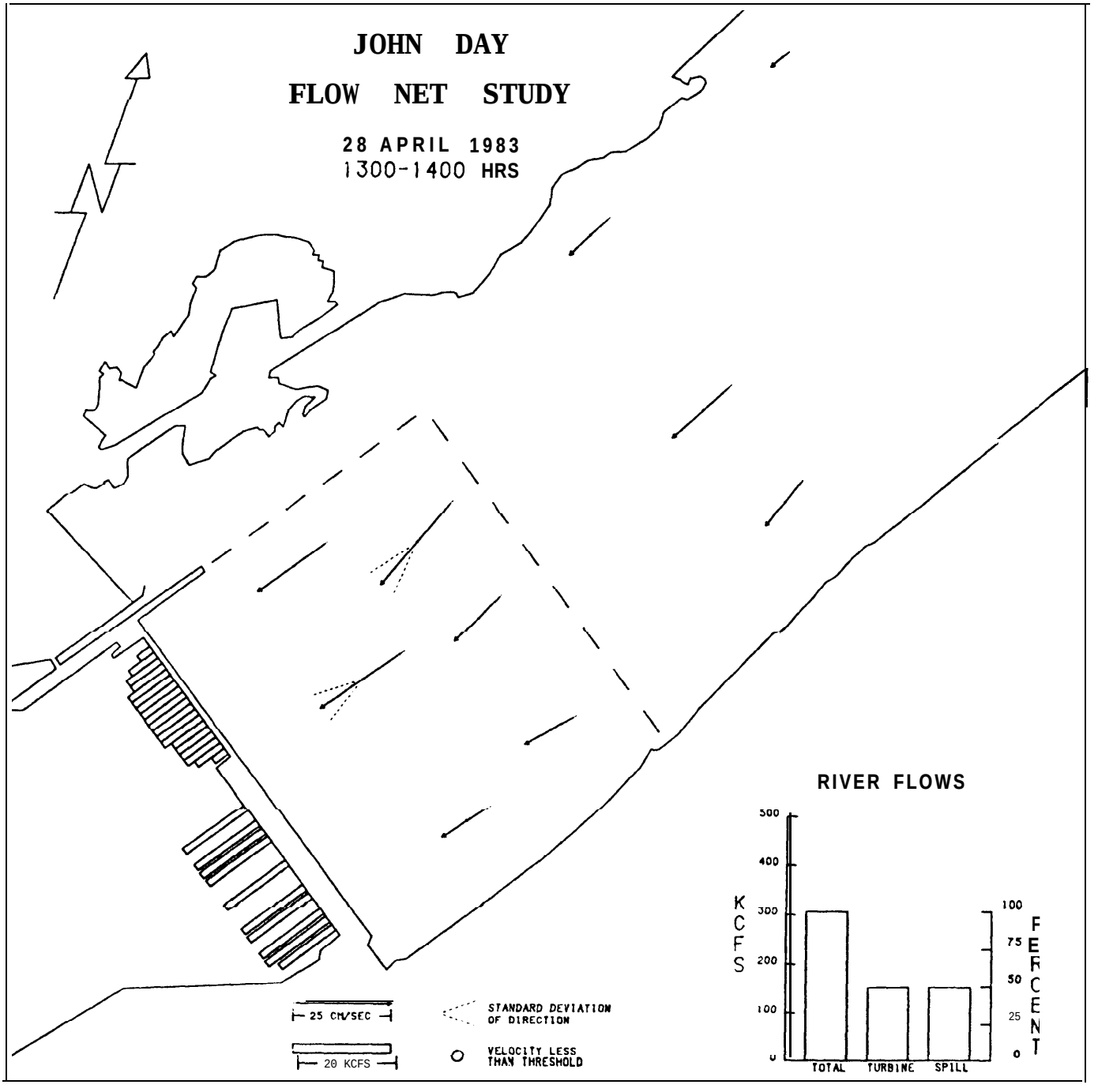

JOHN DAY
FLOW NET STUDY
26 APRIL 1983
1400-1500 HRS
RIVER FLOWS
500
400
300
200
100
0
KCFS
100
75
50
25
0
PERCENT
TOTAL
TURBINE
SPILL
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
VELOCITY LESS THAN THRESHOLD

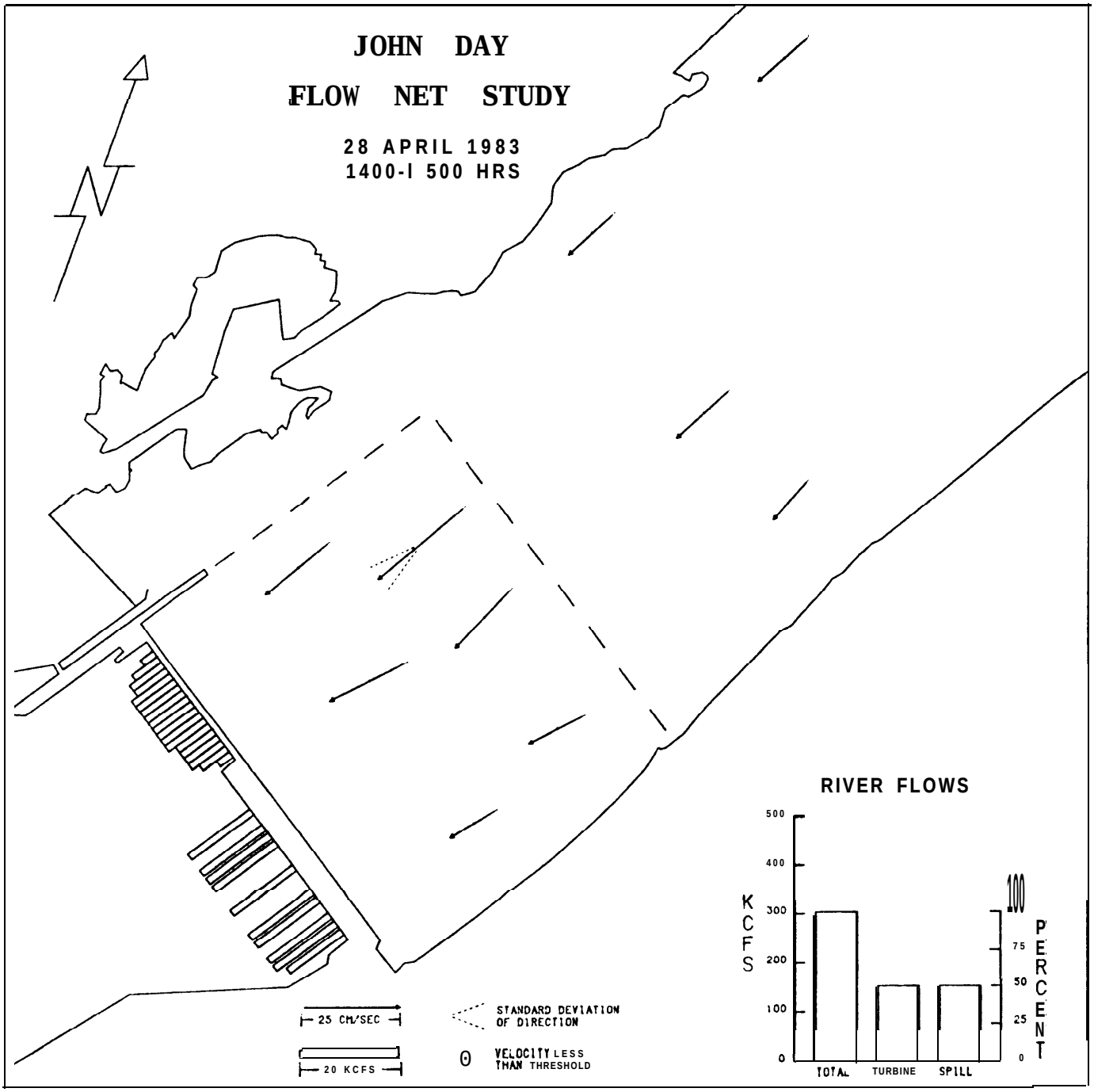

JOHN DAY
FLOW NET STUDY
26 APRIL 1983
1600-I 700 HRS
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
VELOCITY LESS THAN THRESHOLD
RIVER FLOWS
KCFS
500
400
300
200
100
0
100
75
50
25
0
PERCENT
TOTAL
TURBINE
SPILL

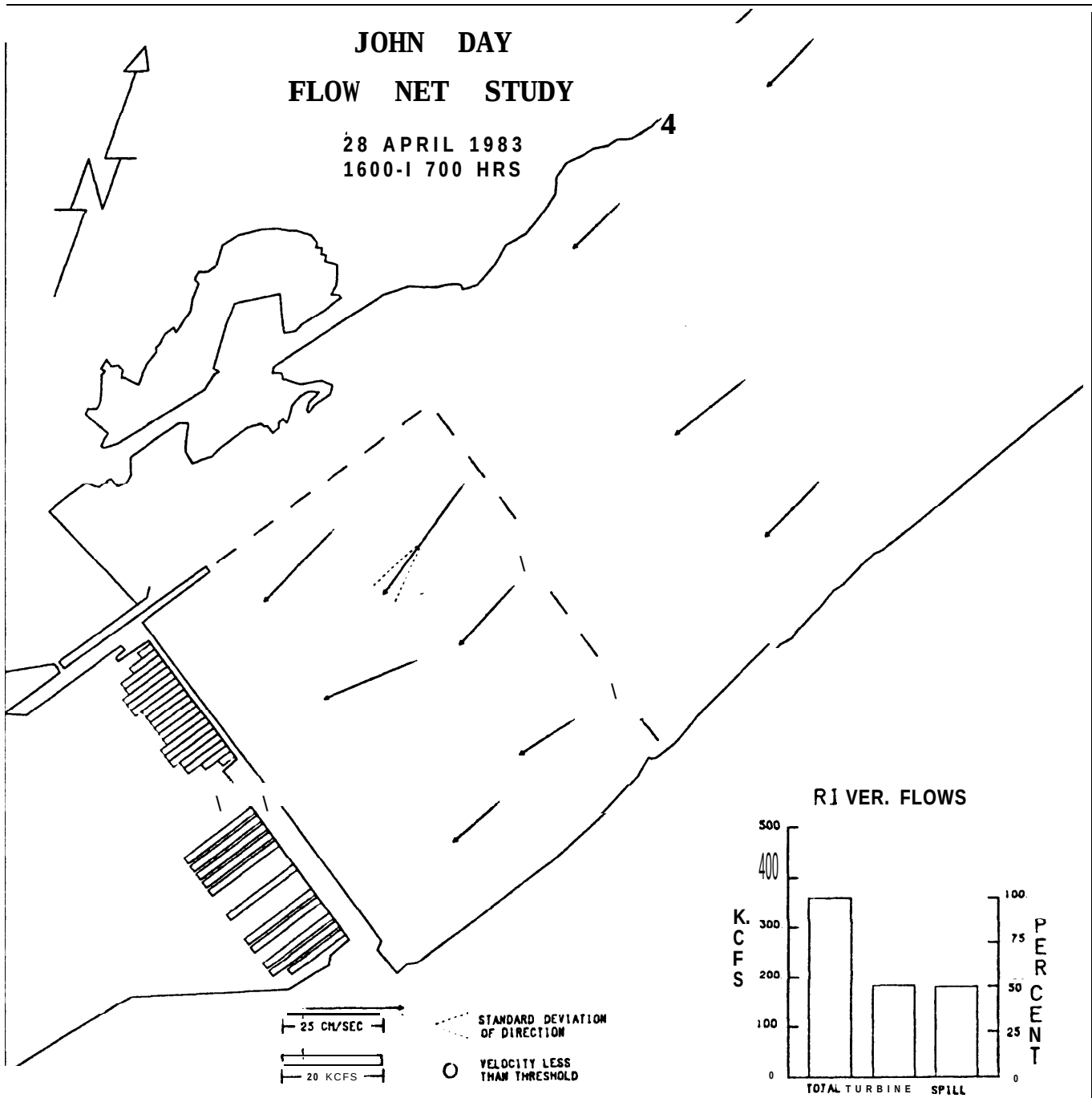

JOHN DAY
FLOW NET STUDY
26 APRIL 1983
1700-1800 HRS
RIVER FLOWS
500
400
300
200
100
0
KCFS
100
75
50
25
0
PERCENT
TOTAL
TURBINE
SPILL
25 CM/SEC
20 KCFS
STANDARD DEVIATION Of DIRECTION
VELOCITY LESS THAN THRESHOLD

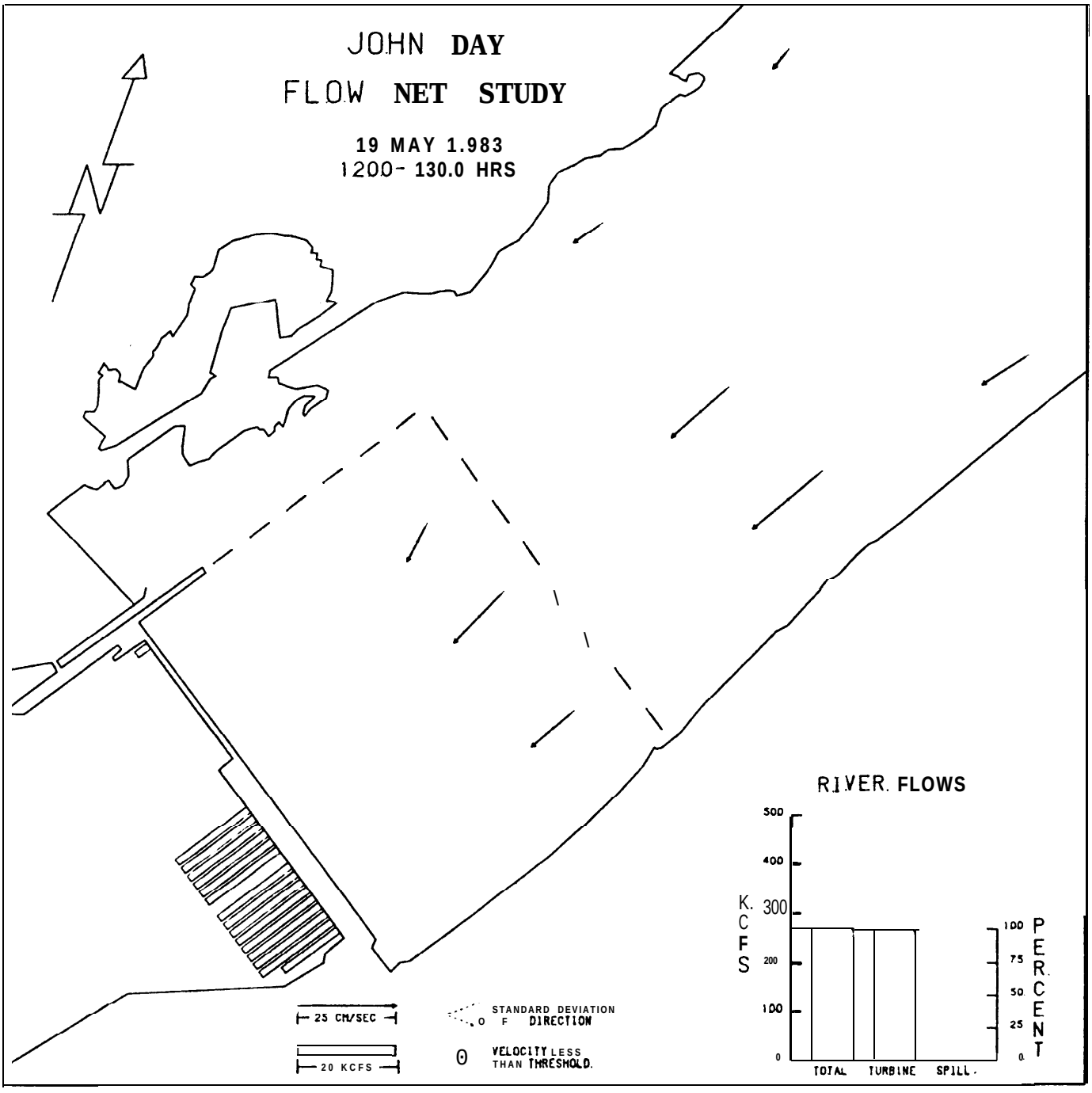

JOHN DAY
FLOW NET STUDY
28 APRIL 1983
1000-1100 HRS
RIVER FLOWS
500
400
300
200
100
0
KCFS
100
75
50
25
0
PERCENT
TOTAL
TURBINE
SPILL
25 CM/SEC
20 KCFS
STANDARD DEVIATION DIRECTION
VELOCITY LESS THAN THRESHOLD

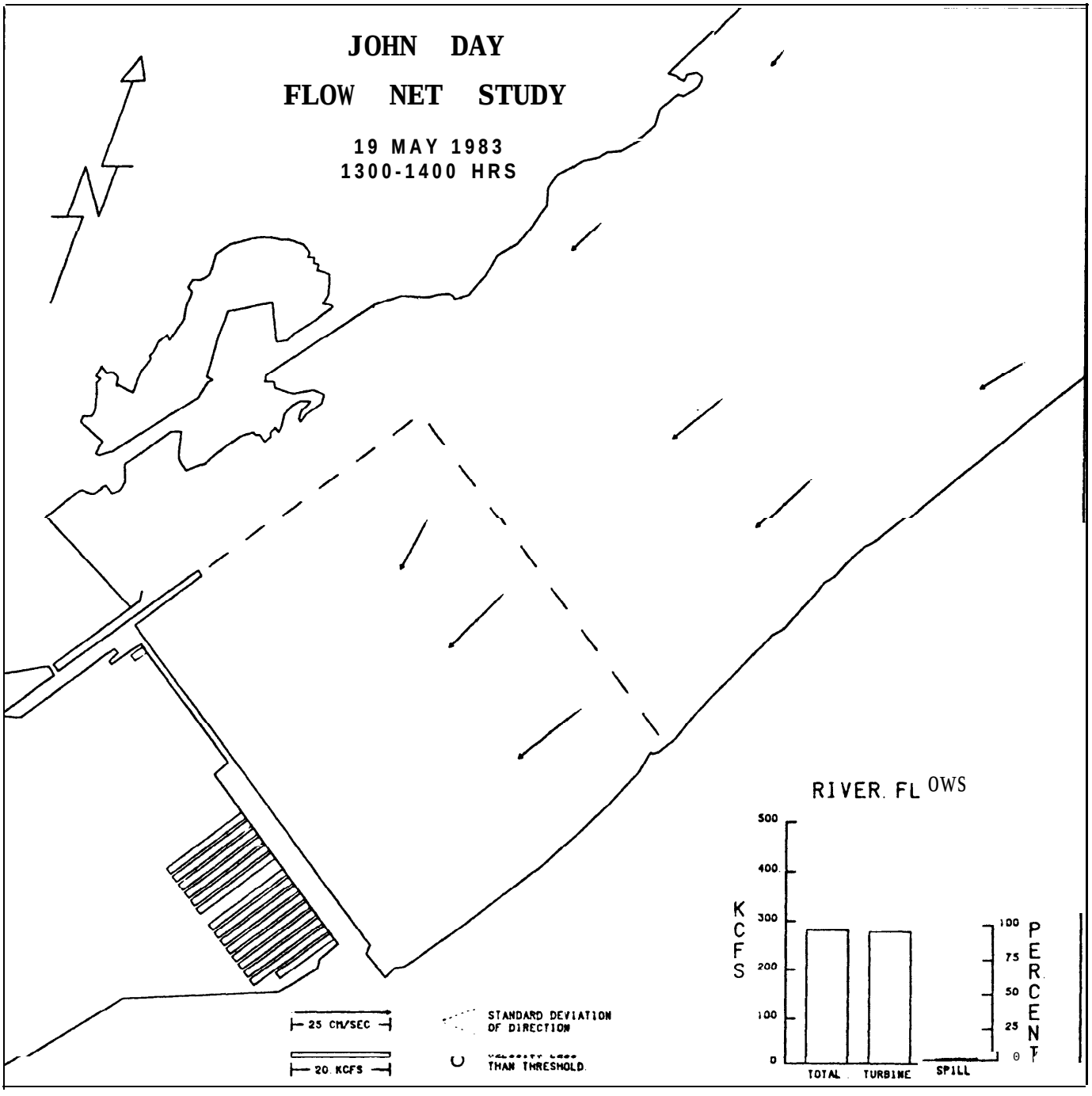

JOHN DAY
FLOW NET STUDY
28 APRIL 1983
1200-1300 HRS
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
VELOCITY LESS THAN THRESHOLD
RIVER FLOWS
KCFS
300
400
300
200
100
0
100
75
50
25
0
PERCENT
TOTAL
TURBINE
SPILL

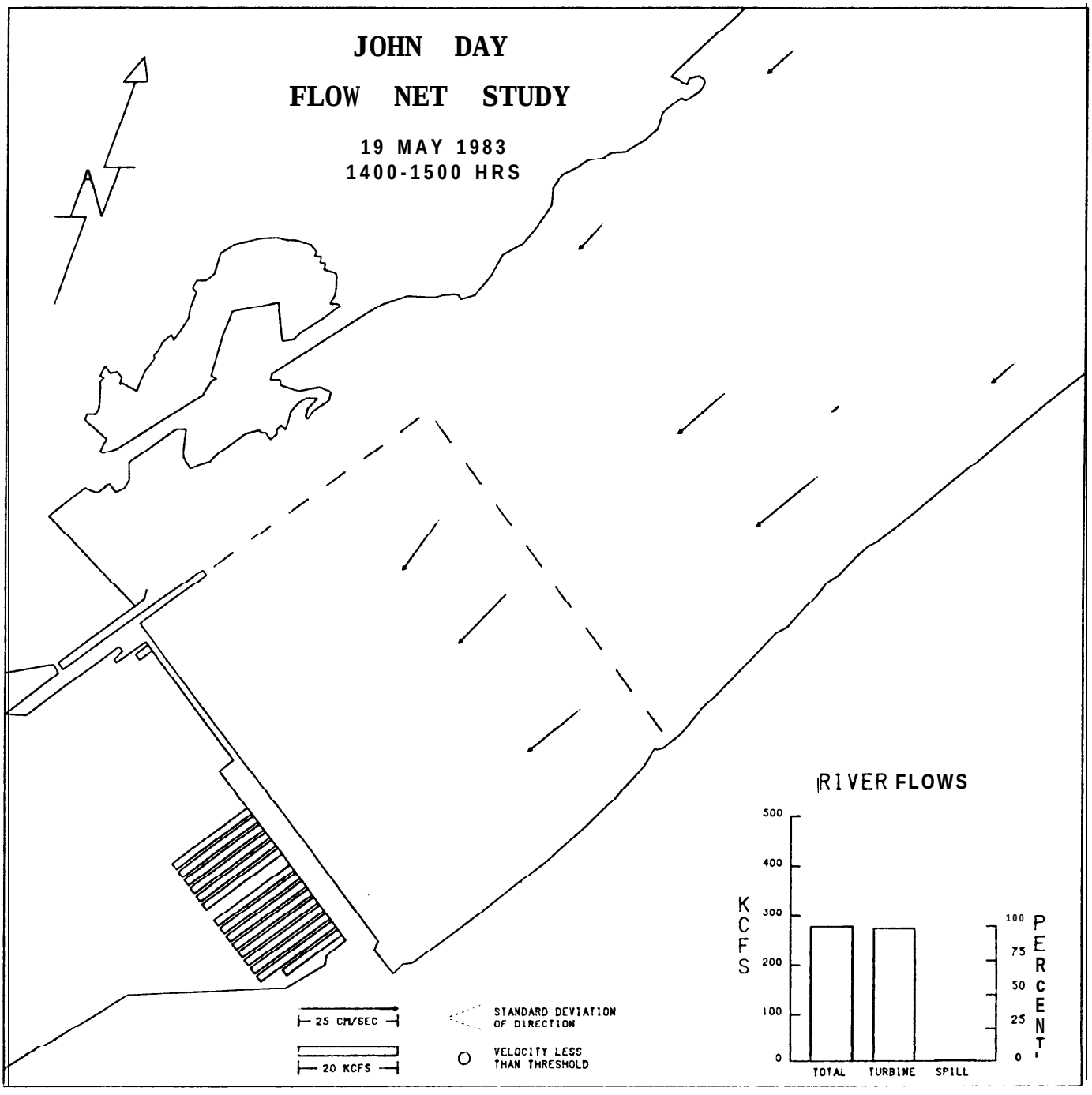

JOHN DAY
FLOW NET STUDY
28 APRIL 1983
1300-1400 HRS
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
VELOCITY LESS THAN THRESHOLD
RIVER FLOWS
KCFS
500
400
300
200
100
0
PERCENT
100
75
50
25
0
TOTAL
TURBINE
SPILL

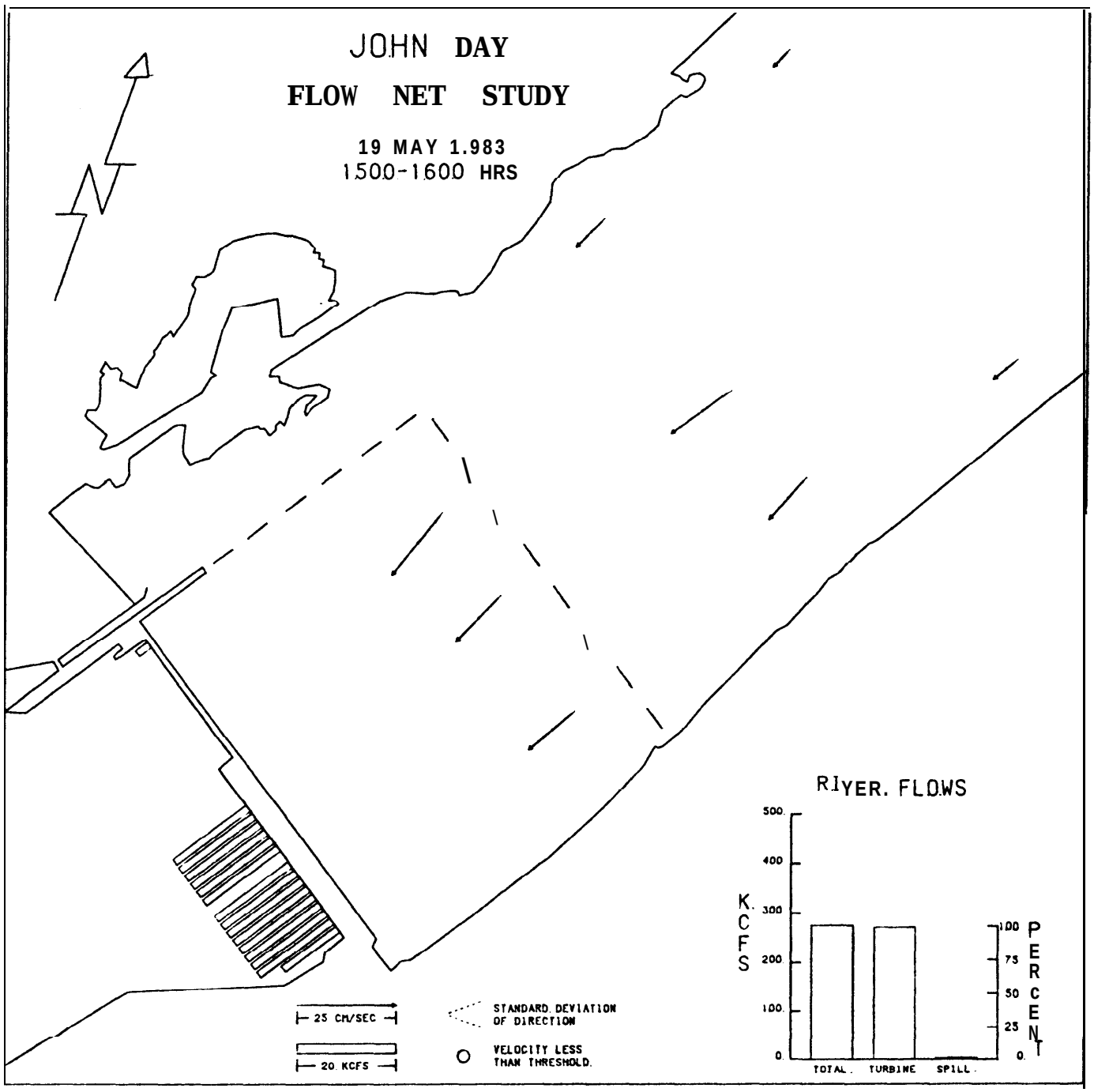

JOHN DAY
FLOW NET STUDY
28 APRIL 1983
1400-I 500 HRS
RIVER FLOWS
500
400
300
200
100
0
KCFS
100
75
50
25
0
PERCENT
TOTAL
TURBINE
SPILL
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
0
VELOCITY LESS THAN THRESHOLD

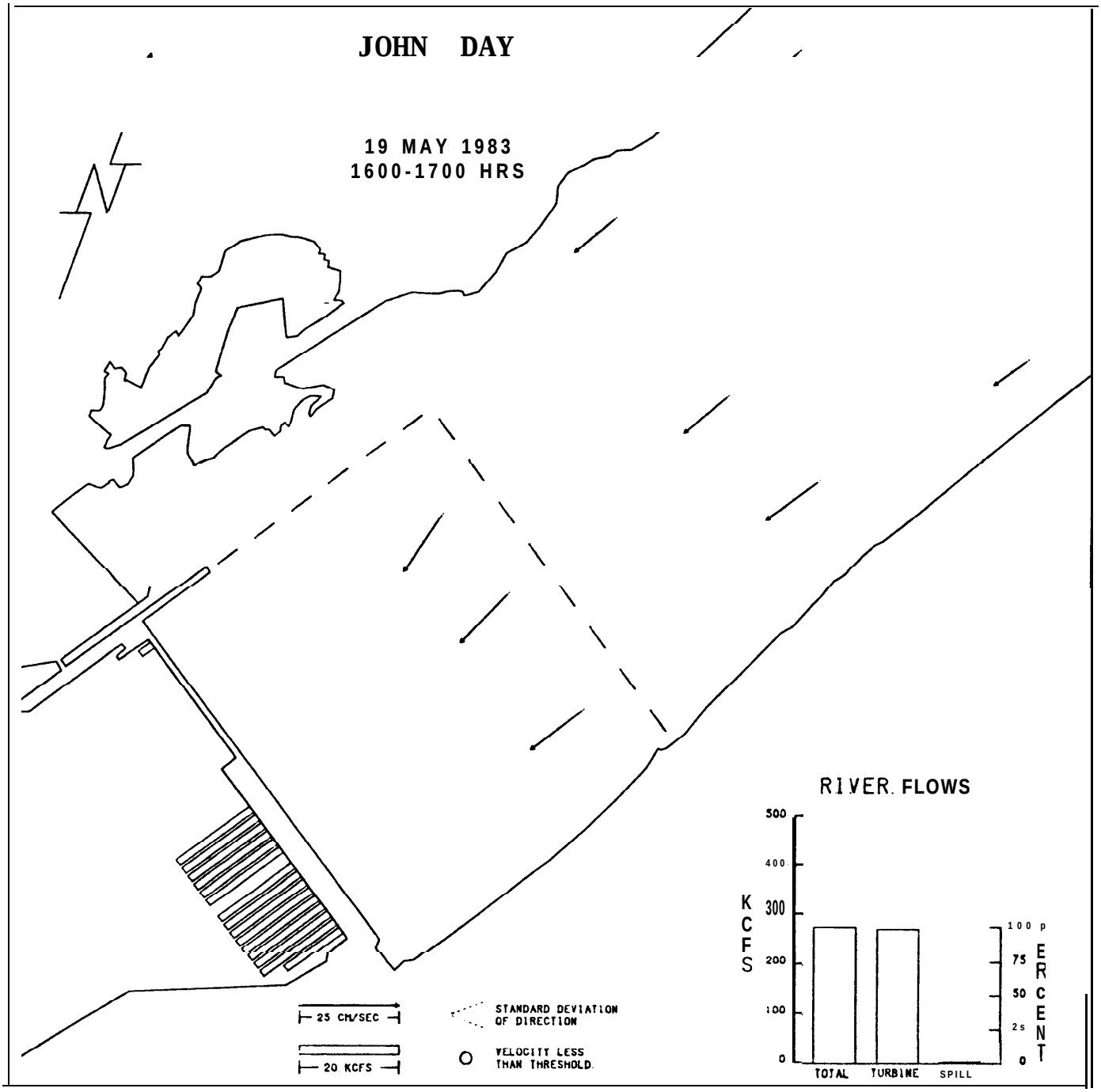

JOHN DAY
FLOW NET STUDY
28 APRIL 1983
1600-I 700 HRS
4
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
VELOCITY LESS THAN THRESHOLD
RIVER. FLOWS
K. CFS
500
400
300
200
100
0
100
75
50
25
0
PERCENT
TOTAL
TURBINE
SPILL

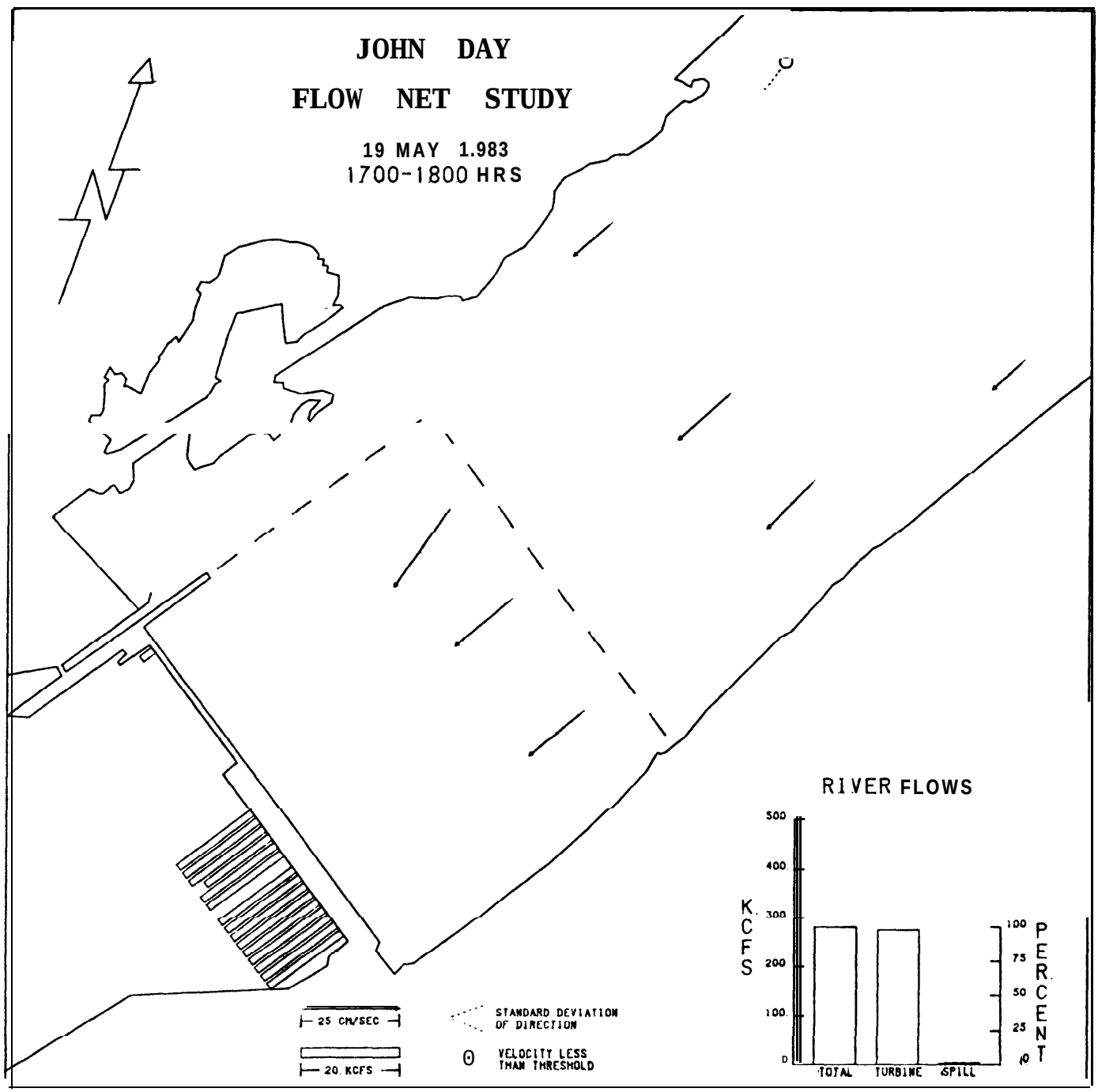

JOHN DAY
FLOW NET STUDY
19 MAY 1.983
1200- 130.0 HRS
RIVER FLOWS
500
400
K. 300
C
F
S
200
100
0
100
75
50
25
0
PERCENT
TOTAL
TURBINE
SPILL
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
0 VELOCITY LESS THAN THRESHOLD.

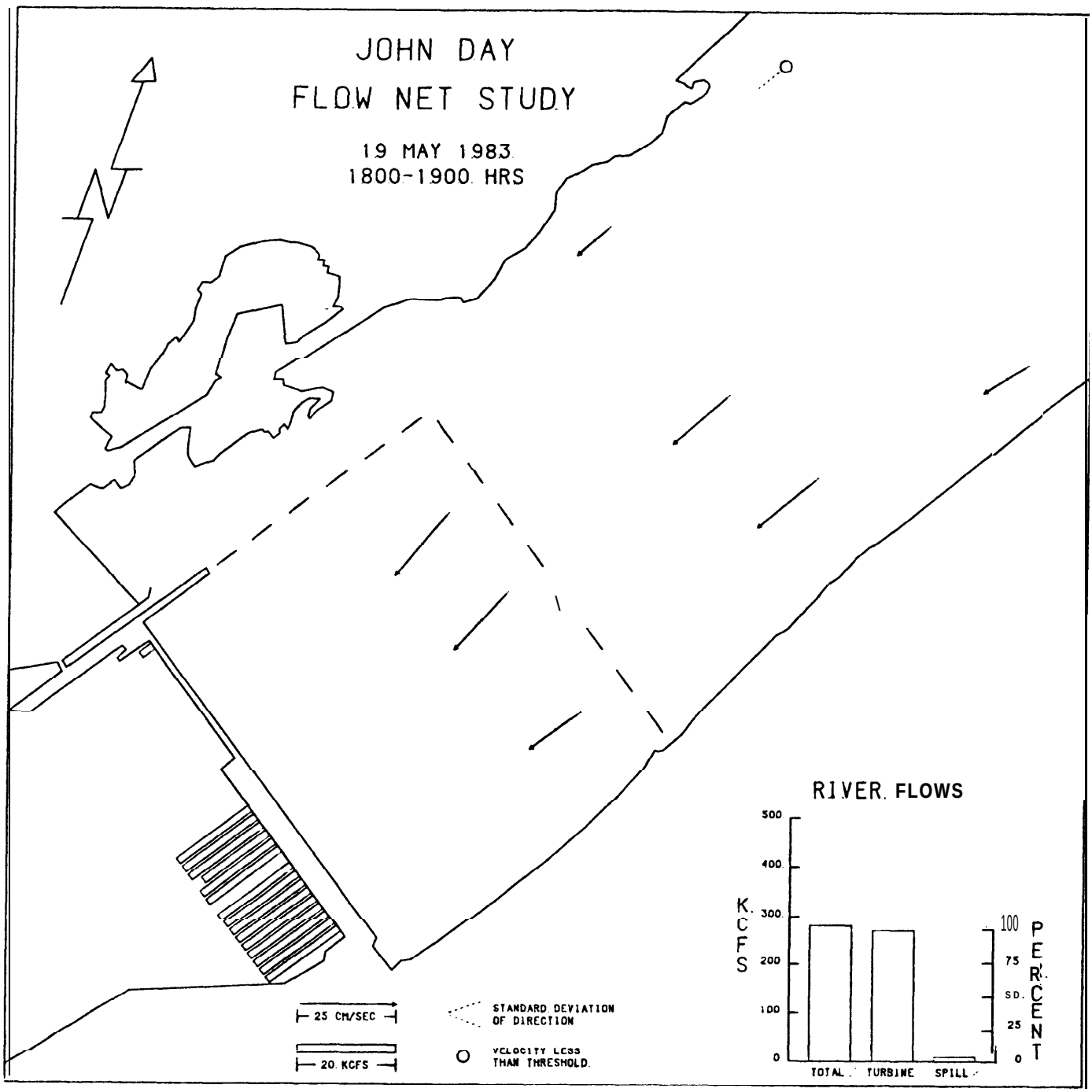

JOHN DAY
FLOW NET STUDY
19 MAY 1983
1300-1400 HRS
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
THAN THRESHOLD
RIVER FLOWS
KCFS
500
400
300
200
100
0
100
75
50
25
0
PERCENT
TOTAL
TURBINE
SPILL

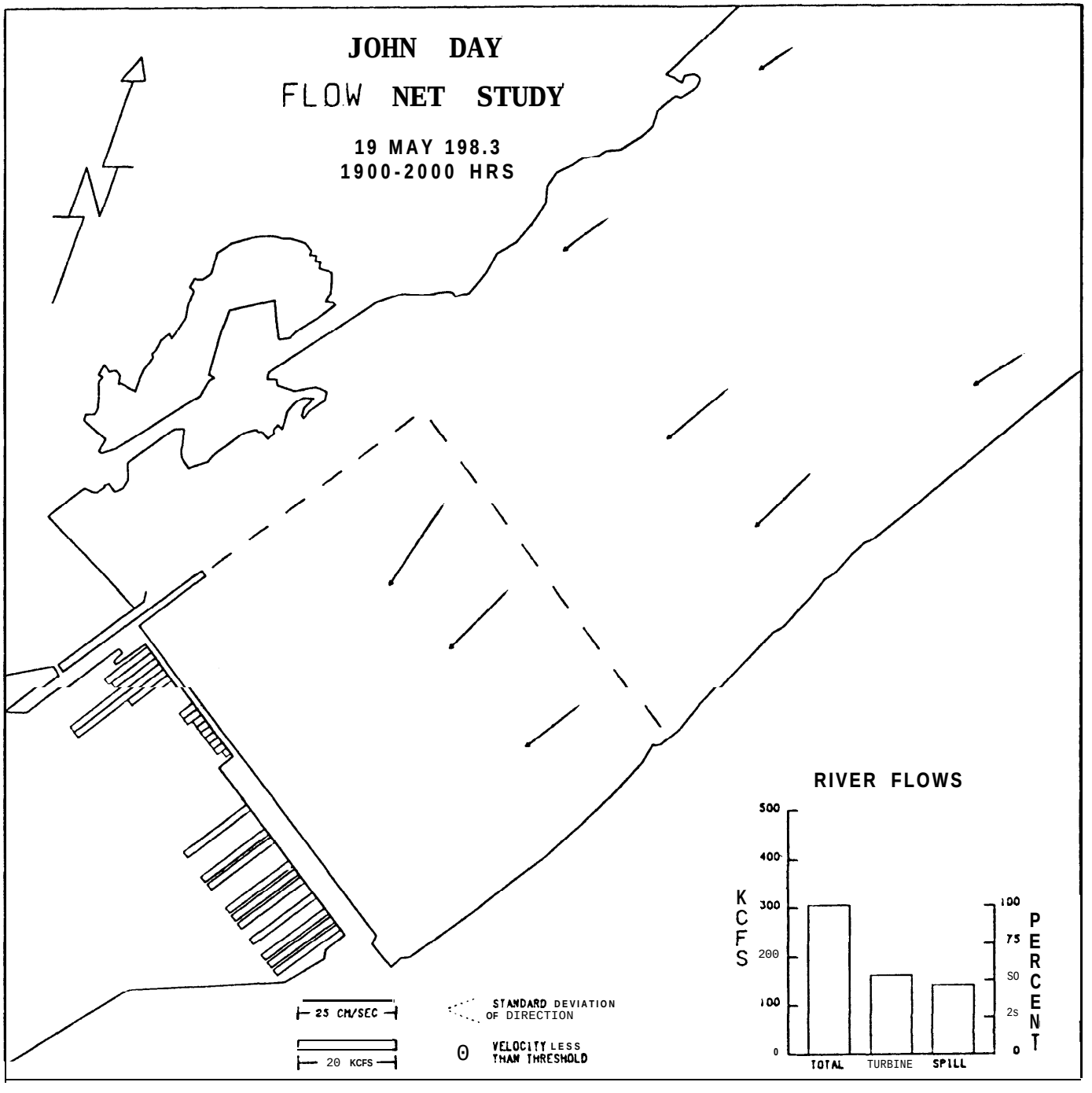

JOHN DAY
FLOW NET STUDY
19 MAY 1983
1400-1500 HRS
RIVER FLOWS
KCFS
PERCENT
500
400
300
200
100
0
100
75
50
25
0
TOTAL
TURBINE
SPILL
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
VELOCITY LESS THAN THRESHOLD


JOHN DAY
FLOW NET STUDY
19 MAY 1.983
1500-1600 HRS
RIVER. FLOWS
500.
400
300
200
100.
0
K. C F S
100
75
50
25
0.
PERCENT
TOTAL.
TURBINE
SPILL.
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
VELOCITY LESS THAN THRESHOLD.


JOHN DAY
19 MAY 1983
1600-1700 HRS
RIVER FLOWS
500
400
300
200
100
0
KCFS
100 p
75
50
2s
0
ERCENT
TOTAL
TURBINE
SPILL
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
VELOCITY LESS THAN THRESHOLD.


JOHN DAY
FLOW NET STUDY
19 MAY 1.983
1700-1800 HRS
RIVER FLOWS
KCFS
500
400
300
200
100
0
PERCENT
100
75
50
25
0
TOTAL
TURBINE
SPILL
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
0 VELOCITY LESS THAN THRESHOLD


JOHN DAY
FLOW NET STUDY
19 MAY 1983
1800-1900 HRS
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
VELOCITY LESS THAN THRESHOLD
RIVER FLOWS
KCFS
500
400
300
200
100
0
100
75
SD.
25
0
PERCENT
TOTAL
TURBINE
SPILL


JOHN DAY
FLOW NET STUDY
19 MAY 198.3
1900-2000 HRS
RIVER FLOWS
500
400
300
200
100
0
KCFS
100
75
50
25
0
PERCENT
TOTAL
TURBINE
SPILL
25 CM/SEC
20 KCFS
STANDARD DEVIATION OF DIRECTION
0
VELOCITY LESS THAN THRESHOLD

JOHN DAY	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
DAR	83042.	9	330.4	249.2	80. 7	24. 4	264. 8

SPILL 1-10	1. 6	1 6	3 2	3. 2	4. 8	4. 8	4. 8	4. 8	6. 4	6. 4
DAYS 11-20	6. 4	6. 4	4. a	4. 8	4. 8	4. 8	1. 6	3. 2	1. 6	a. 0
TURBINE 1 10	13. 6	18 3	18. 3	18. 3	1 8 . 3	1 8 . 3	18. 3	18. 3	18. 3	0. 0
UNITS 11-16	18. 3	18 3	15. a	18. 3	0. 0	18. 3				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1. 0	-1 0	-1	-1. 0	2	-1. 0	-1.0	-1	-1. 0
3	-1. 0	i. 0	-1	-1. 0	4	-1. 0	-1. 0	-1	-1. 0
5	-1. 0	i. 0	-1	-1. 0	6	-1. 0	-1.0	-1	-1. 0
7	207. 1	5. 0	20	0. 6	8	-1. 0	-1. 0	-1	-1. 0
9	197. 9	2. a	24	1. 6	10	-1. 0	-1. 0	-1	-1. 0
11	192. 9	5. 5	13	1 5	12	-1. 0	-i. 0	-1	-1. 0
13	211. 8	9 9	13	0. 4	14	200. 5	10. 4	19	2. 0
15	196. 5	11. 9	24	1 8	16	200.3	12 8	18	0. 8
17	202. 6	6. 7	24	0. 7	18	202. 8	10. 1	13	1. 1
19	-1. 0	-1. 0	-1	-1. 0	20	205. 5	12. 8	17	2. 8

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830426	13	352.0	149.9	199.a	56.8	264.5

SPILL 1-10	4.8	8 0	9.6	9.6	11.2	11.2	12.8	12.8	12.8	12.8
DAYS 1 1-20	12.0	12 a	12. a	11.2	11.2	11.2	9.6	a. 0	6.4	4. a
TURBINE 1 10	13.	13 4	13. 4	13. 4	13. 4	13. 4	13. 4	0. 0	13. 4	0. 0
UNITS 11 16	13. 4	0. 0	15. a	0. 0	0. 0	13. 4				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	-1. 0	-1	-1. 0	2	-1. 0	-1. 0	-1	-1. 0
3	-1.0	-1. 0	-1	-1. 0	4	-1. 0	-1. 0	-1	-1. 0
5	-1.0	-1. 0	-1	-1. 0	6	-1. 0	-1. 0	-1	-1.0
7	212.5	11 4	12	0. 5	8	-1. 0	-1. 0	-1	-1. 0
9	222.0	a. 9	24	1. 5	10	-1.0	-1. 0	-1	-1. 0
11	207.9	14.8	22	1. 4	12	-1. 0	-1. 0	-1	-1. 0
13	225.6	9. 9	12	0. 6	14	205.4	11.8	20	0. 9
15	196.0	11.3	28	1. 1	16	137.5	10.1	16	0. 7
17	209.9	7. 7	26	0. 7	18	207. 7	7. 2	12	1. 1
19	-1.0	-1.0	-1	-1. 0	20	201.9	7. 0	15	3. 5

JOHN DAY DAM	DATE	HOUR	* TOTAL	RIVER FLOWS TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830426	1 4	351.5	172.1	178.9	50.9	264.6

SPILL 1-10	4.8	8 0	9.6	9.6	9.6	9.6	9.6	9.6	11.2	11.2
BAYS 11-20	11.2	11.2	9.6	9.6	9.6	9.6	9.6	8.0	6.4	4.a
TURBINE 1 10	13.6	15 8	15.a	15.8	15.8	15.8	15.8	0.0	15.8	0.0
UNITS 11 16	15.8	0 0	15.8	0.0	0.0	15.8				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	-1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	-1.0	-1.0	-1	-1.0	4	-1.0	-1.G	-1	-1.0
5	1.0	-1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	209.2	8.4	13	0.6	8	-1.0	-1.0	-1	-1.0
9	217.6	13.0	22	0.9	10	-1.0	-1.0	-1	-1.0
11	206.8	15.7	22	1.5	12	-1.0	-1.G	-1	-1.0
13	217.2	11.2	13	0.6	14	203.8	11.5	20	0.8
15	202.8	11.7	33	1.2	16	198.2	14.1	21	0.8
17	207.4	6.2	21	1.2	18	205.2	9.7	13	1.1
19	-1.0	-1.0	-1	-1.0	20	193.6	5.5	9	2.5

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830426	15	348.8	144.2	204.0	58.5	264.6

SPILL 1-10	4.6	7.6	9.2	10.4	11.2	12.0	12.4	12.4	12.8	12.8
DAYS 1 1-20	12.3	12 8	12.4	12.0	12.0	12.0	10.4	8.8	6.0	4.8
TURBINE 1 10	13.6	14 4	14.4	0.0	14.4	14.4	14.4	0.0	14.4	0.0
UNITS 11 16	14 4	0 0	15.8	0.0	0.0	14.4				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	1.0	1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	1.0	-1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	1.0	1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	208.1	4.6	10	1.1	8	-1.0	-1.0	-1	-1.0
9	221.3	13.2	21	0.5	10	-1.0	-1.0	-1	-1.0
11	204.3	14.7	22	2.3	12	-1.0	-1.0	-1	-1.0
13	221.6	8.7	13	1.0	14	200.7	6.8	18	0.8
15	200.8	10.6	33	1.2	16	205.3	7.7	14	0.4
17	205.7	8.3	24	1.4	18	204.0	7.1	13	1.0
19	1.0	-1.0	-1	-1.0	20	186.3	5.8	9	2.5

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830426	17	350.2	129.4	218. 5	62. 4	264. 4

SPILL 1-10	4. 8	8. 0	9. 6	11. 2	12. 8	12. 8	12. 8	12. 8	12. 8	14. 3
DAYS 11-20	12. 0	12. 8	12. 8	12. 8	12. 8	12. 8	11. 2	9. 6	6. 4	4. 8
TURBINE 1 10	13. 6	14. 3	14. 3	0. 0	14. 3	0. 0	14. 3	0. 0	14. 3	0. 0
UNITS 11-16	14. 3	0 0	15. 8	0. 0	0. 0	14. 3				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	1. 0	-1. 0	-1	-1. 0	2	-1. 0	-1. 0	-1	-1. 0
3	-1. 0	-1. 0	-1	-1. 0	4	-1. 0	-1. 0	-1	-1. 0
5	-1. 0	-1. 0	-1	-1. 0	6	-1. 0	-1. 0	-1	-1. 0
7	216. 1	10. 8	7	0. 7	8	-1. 0	-1. 0	-1	-1. 0
9	220. 0	14. 2	25	0. 9	10	-1. 0	-1. 0	-1	-1. 0
11	205. 4	12. 0	29	1. 9	12	-1. 0	-1. 0	-1	-1. 0
13	215.8	11. a	9	0. 8	14	204. 5	9. 7	19	0. 7
15	305.2	12. 8	33	0. 8	16	195.4	8. 3	lb	0. 9
17	117. 6	5. 5	25	0. 9	18	200. 1	a. 6	13	0. 6
19	-1. 0	-1. 0	-1	-1. 0	20	203.0	10. 7	11	1. 7

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830416	18	353.0	150.2	200.5	56.8	264.3

SPILL 1-10	4.6	6.6	8.2	9.8	11.4	11.4	12.7	12.7	12.7	13.0
BAYS 11-20	12.7	12.7	12.7	11.4	11.4	11.4	9.8	8.2	5.0	4.a
TURBINE 1-10	13.7	17.2	17.2	0.0	17.2	0.0	17.2	0.0	17.2	0.0
UNITS 11-16	17.2	0.0	15.8	0.0	0.0	17.2				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	1.0	-1.0	-1	-1.0	2	-1.0	-1,0	-1	-1.0
3	-1.0	-1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	1.0	-1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	202.3	2.7	10	1.5	8	-1.0	-1.0	-1	-1.0
9	215.4	15.9	25	0.a	10	-1.0	-1.0	-1	-1.0
11	209.1	12.3	26	1.7	12	-1.0	-1.0	-1	-1.0
13	210.7	9.4	14	0.5	14	201.0	11.0	20	0.8
15	201.5	12.4	33	1.8	16	201.6	12.4	14	0.5
17	205.8	7.7	27	2.0	18	201.8	9.0	18	1.8
'19	-1.0	-1.0	-1	-1.0	20	207.7	11.6	11	1.6

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830426	19	348.7	170.2	178.0	51.0	264.3

SPILL 1-10	4.8	6.4	8.0	9.6	10.1	10.1	10.1	10.1	11.1	11.1
BAYS 11-2	11.1	11.1	11.1	10.1	10.1	10.1	9.6	8.0	4.8	4.8
TURBINE 1-10	13.4	17.6	17.6	0.0	17.6	0.0	17.6	0.0	17.6	0.0
UNITS 11-16	17.6	17.6	15.8	0.0	0.0	17.6				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	-1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	-1.0	-1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	-1.0	-1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	214.4	3.4	12	1.3	8	-1.0	-1.0	-1	-1.0
9	211.9	10.2	23	2.4	10	-1.0	-1.0	-1	-1.0
11	200.5	10.2	26	1.4	12	-1.0	-1.0	-1	-1.0
13	212.3	7.5	11	1.1	14	200.4	7.3	18	1.2
15	X3.6	13.9	31	1.2	16	197.9	4.3	14	0.7
17	205.0	7.4	24	1.8	18	203.5	9.2	17	2.3
19	-1.0	-1.0	-1	-1.0	20	198.7	10.1	22	1.8

JOHN DAY DAM	DATE	HOUR.	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830428	7	340.2	169.6	168.3	49.5	264.3

SPILL BAYS	1-10	3 2	6 4	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
	11-20	9:6	9.6	9.6	9.6	9.6	9.6	9.6	8.0	6.4	3.2
TURBINE UNITS	1-10	13.7	17.1	17.1	0.0	17.1	0.0	17.1	0.0	17.1	0.0
	11-16	17.1	17 1	15.8	0.0	0.0	17.1				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	1.0	1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	-1.0	-1.0	-1	-I. 0	6	-1.0	-1.0	-1	-1.0
7	204.6	11.6	15	1.2	8	-1.0	-1.0	-1	-1.0
9	213.2	13.1	23	2.2	10	-1.0	-1.0	-1	-1.0
11	197.7	10 4	17	1.3	12	-1.0	-1.0	-1	-1.0
13	215.6	11.9	19	0.8	14	203.8	9.4;	21	2.1
15	135.6	5 2	20	1.3	16	205.7	8.0	22	1.4
17	204.3	7:3	21	0.4	18	208.0	8.0	7	1.0
19	-1.0	-1.0	-1	-1.0	20	184.6	8.0	4	1.6

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830426	8	350.6	273.2	75.1	21.4	264.5

SPILL 1-10	1.6	3 2	3.2	3.2	3.2	3.2	3.2	3.2	4.8	4.8
BAYS 11-20	4.8	4.8	3.2	3.2	3.2	3.2	3.2	3.2	3.2	0.0
TURBINE 1-10	13.7	20 3	20.3	0.0	20.3	20.3	20.3	0.0	20.3	0.0
UNITS 11-16	20.3	20 3	15.7	20.3	0.0	20.3				

METER POS	DIR	SP DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	1.0	-1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	-1.0	-1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.G
5	-1.0	-1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	206.3	14.9	20	1.2	8	-1.0	-1.0	-1	-1.0
9	185.9	8.6	21	0.7	10	-1.0	-1.0	-1	-1.0
11	192.4	6.1	12	1.7	12	-1.0	-1.0	-1	-1.0
13	215.1	10.7	18	1.2	14	205.0	11.9	26	1.7
15	133.6	6.1	18	3.4	16	204.8	7.9	25	1.6
17	204.4	7.1	24	1.5	18	206.3	5.9	10	1.1
19	-1.0	-1.0	-1	-1.0	20	195.6	6.6	5	0.7

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOR EBAY ELEV.
	830428	9	322. 2	264. 2	79. 5	23. 4	264. 8

SPILL 1-10	1 [illegible]	3. 2	3. 2	3. 2	4. 8	0. 0	4. 8	3. 2	4. 8	4. 8
BAYS 1 1-20	4: [illegible]	4. e	3. 2	3. 2	3. 2	3. 2	3. 2	3. 2	3. 2	0. 0
TURBINE 1-10	13. 7	20 6	20. 8	0. 0	20. 8	20. 8	20. 8	0. 0	20. 8	0. 0
UNITS 11-16	20. [illegible]	20. 6	20. 8	20. 8	0. 0	20. 8				

METR POS	DIR	SP DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	-1.0	-1	-1. 0	2	-1. 0	-1. 0	-1	-1. 0
3	-1.0	-1.0	-1	-1.0	4	-1. 0	-1.0	-1	-1. 0
5	-1.0	-1.0	-1	-1.0	6	-1. 0	-1. 0	-1	-1. 0
7	206. 0	12. 6	20	0. 8	8	-1. 0	-1.0	-1	-1. 0
9	185 1	8. 1	18	1.2	10	-1.0	-2.0	-1	-1.0
11	172. 1	20. 6	6	0. 7	12	-1.0	-1. 0	-1	-1. 0
13	223. 8	4. 6	16	0. 8	14	207. 3	12. 2	27	2. 3
15	136.0	5. 4	15	0. 7	16	204. 0	8. 3	17	1. 5
17	201. 7	6. 4	20	1.0	18	201.1	7. 3	6	0. 7
19	1.0	-1.0	-1	-1. 0	20	190.9	6. 9	3	1.4

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830428	10	302.1	156.1	145.5	48.2	264.7

SPILL 1-10	3.2	5.6	8.0	8.8	8.8	0.0	9.6	9.6	9.6	9.6
BAYS 1 1-20	9.6	9.6	9.6	9.6	9.6	9.6	8.8	6.4	3.2	0.0
TURBINE 1 10	13.7	15.8	15.8	0.0	13.8	15.8	0.0	0.0	15.8	0.0
UNITS 11-16	0.0	15.8	15.8	15.8	0.0	15.8				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	-1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	-1.0	-1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	-1.0	-1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	205.8	6.8	7	0.7	8	-1.0	-1.0	-1	-1.0
9	202.7	15.1	20	1.1	10	-1.0	-1.0	-1	-1.0
11	206.6	8.9	13	1.3	12	-1.0	-1.0	-1	-1.0
13	223.5	7.8	13	0.7	14	199.1	9.6	20	1.0
15	135.8	6.8	14	1.7	16	200.9	12.1	22	0.8
17	200.4	8.2	19	0.8	18	204.4	7.1	7	0.9
19	-1.0	-1.0	-1	-1.0	20	178.5	16.9	1	1.1

JOHN DAY DAN	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830428	11	301.0	149.1	151.4	50.3	264.8

SPILL BAYS	1-10	3.2	6 4	9.6	9.6	9.6	0.0	9.6	9.6	9.6	9.6
	11-20	9.6	9 6	9.6	9.6	9.6	9.6	9.6	6.4	3.2	0.0
TURBINE UNITS	1 10	13.4	15 0	15.0	0.0	15.0	15.0	0.0	0.0	15.0	0.0
	11 16	0.0	15 0	15.5	15.0	0.0	15.0				

METER POS	DIR	SP DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	-1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	-1.0	-1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	-1.0	-1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	204.4	8.6	13	1.1	8	-1.0	-1.0	-1	-1.0
9	215.5	15.1	22	1.0	10	-1.0	-1.0	-1	-1.0
11	203.6	11.6	14	1.1	12	-1.0	-1.0	-1	-1.0
13	215.0	12.7	17	1.1	14	199.6	12.1	21	1.4
15	133.2	9.9	21	1.0	16	202.5	13.2	20	2.1
17	204.1	8.8	21	0.8	18	202.8	8.0	8	0.4
19	-1.0	-1.0	-1	-1.0	20	188.4	6.4	4	0.7

JOHB DAY	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SF ILL	FOREBAY ELEV.		
DAM	830428	12	303.9	151.4	152.0	50.0	264.6		
SPILL 1-10	3.2	6 4	9.6	9.6	9.6	0.0	9.6	9.6'	9.6	9.6
S-Y 11-20	9.6	9 6	9.6	9.6	9.6	9.6	9.6	6.4	3.2	0.0
TURBINE 1 10	13.5	15 4	15.3	0.0	15.4	15.4	0.0	0.0	15.4	0.0
UNITS 11-16	0.0	15 4	15.5	15.4	0.0	15.4				

METER POS	GIR	SP DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	1.0	-1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	1.0	-1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	1.0	-1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	214.0	10.5	12	0.6	6	-1.0	-1.0	-1	-1.0
9	216.8	13.1	21	0.7	10	-1.0	-1.0	-1	-1.0
11	205.8	12.3	15	1.0	12	-1.0	-1.0	-1	-1.0
13	214.0	9.3	13	0.4	14	196.6	5.9	16	1.1
15	190.5	12.6	21	0.7	16	197.9	5.0	17	1.5
17	211.3	8.5	21	1.0	18	206.4	6.4	7	0.6
19	-1.0	1.0	-1	-1.0	20	186.5	5.6	3	1.3

JOHN DAY DAM	DATE	HOUR	*	RIVER FLOWS TOTAL	TURBINE	SPILL	*	PERCENT SPILL	FOREBAY ELEV.		
	830428	13		304.6	152.2	151.9		49. 9	264. 7		
SPILL 1-10	3. 2	6. 4		9. 1	9. 1	9. 1	2. 4	9. 6	9. 6	9. 6	9. 6
BAYS 11-20	9. 6	9. 6		9. 6	9. 6	9. 6	9. 1	9. 1	6. 4	3. 2	0. 0
TURBINE 1-10	13. 5	15 4		15. 4	0. 0	15. 4	15. 4	0. 0	0. 0	15. 4	0. 0
UNITS 11-16	0. 0	15 4		15. 5	15. 4	0. 0	15. 4				

METER POS	DIR	SP DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1. 0	-1. 0	-1	-1. 0	2	-1. 0	-1. 0	-1	-1. 0
3	-1. 0	-1. 0	-1	-1. 0	4	-1. 0	-1. 0	-1	-1. 0
5	-1. 0	-1. 0	-1	-1. 0	6	-1.0	-1.0	-1	-1. 0
7	207. Y	10. 8	13	0. 5	8	-1. a	-1. 0	-1	-1. 0
9	222. 7	14. 5	23	1. 2	10	-1. 0	-1. 0	-1	-1. 0
11	174. 8	11 9	16	1. 2	12	-1. 0	-1. 0	-1	-1. 0
13	213. 3	11 3	15	0. 6	14	202. 1	10. 3	19	1. 4
15	187. 7	9. 9	21	0. 7	16	204. 0	8. 3	16	0. 9
17	201. 8	6. 6	20	0. 7	18	205.4	6. 2	8	0. 6
19	1. 0	-1. 0	-1	-1. 0	20	188. 5	4. 9	2	1. 0

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830428	14	306. 2	151.9	152.0	49. 6	264. 7

SPILL	1-10	3. 2	6. 4	8. 0	8. 0	8. 0	8. 0	9. 6	9. 6	9. 6	9. 6
RAYS	11-20	9. 6	9. 6	9. 6	9. 6	9. 6	8. 0	8. 0	6. 4	3. 2	0. 0
TURBINE	1-10	13. 5	15. 4	15. 4	0. 0	15. 4	15. 4	0. 0	0. 0	15. 4	0. 0
UNITS	11-16	0. 0	15. 4	15. 5	15. 4	0. 0	15. 4				

METER POS	DIR	SP DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1. 0	-1.0	-1	-1. 0	2	-1.0	-1. 0	-1	-1. 0
3	-1. 0	-1.0	-1	-1. 0	4	-1.0	-1. 0	-1	-1.0
5	-1. 0	-1.0	-1	-1. 0	6	-1. 0	-1. 0	-1	-1.0
7	223.0	10. 6	15	0. 8	8	-1.0	-1. 0	-1	-1.0
9	213. 1	16. 9	26	1. 0	10	-1.0	-1. Q	-1	-1. 0
11	212.1	13 1	22	1. 7	12	-1.0	-1. 0	-1	-1. 0
13	218. 3	16. 3	15	0. 5	14	202. 8	8. 4	17	1. 3
15	138. 1	16. 3	28	1. 6	16	197.2	7. 5	16	1. 1
17	205. 8	6. 8	20	0. 9	18	205: 0	10. 0	14	0. 9
19	-1. 0	-1. 0	-1	-1. 0	20	209.3	9. 3	7	0. 8

JOHN DAY	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
Df?M	830428	17	360. 1	181. 2	178. 3	49. 5	264.5

SP ILL	l-10	3. 2	6. 4	9. 6	9. 6	11.2	11.2	11.2	9. 6	9. 6	9. 6
DAYS 1	1-20	9. 6	9. 6	9.6	11.2	11. 2	11. 2	9. 6	9. 6	6. 4	3. 2
TURBINE 1	10	13. 6	16. 8	16. 8	0. 0	16. 8	16. 8	0. 0	0. 0	16. 8	0. 0
UNITS 11	-16	0. 0	16. 8	16. 8	16. 8	16. 8	16. 8				

METER POS	SP DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1. 0	-1.0	-1	-1. 0	2	-1. 0	-1. 0	-1	-1.0
3	-1. 0	-1.0	-1	-1. 0	4	-1. 0	-1.0	-1	-1. 0
5	-1. 0	-1. 0	-1	-1. 0	6	-1. 0	-1.0	-1	-1. 0
7	207. 8	7. 8	15	1. 1	8	-1. 0	-1.0	-1	-1. 0
9	225. 7	10. 4	25	1. 3	10	-1. 0	-1. 0	-1	-1. 0
11	202.4	10. 8	25	2. 0	12	-1. 0	-1.0	-1	-1.0
13	214. Y	10. 3	16	1. 9	14	200.7	9. 1	20	1. 1
15	213 4. 2	11. 4	34	1. 1	16	202. 1	10. 1	19	1. 1
17	209. 5	6. v	22	1. 1	18	204. 0	6. 4	16	2. 0
19	-1. 0	-1. 0	-1	-1.0	20	202.1	5. 8	16	1. 4

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL	*	PERCENT SPILL	FOREBAY ELEV.
	830428	1 8	360.2	180.7	179.1		49. 7	264.5

SPILL 1-10	3. 2	6 4	9.6	9.6	11.2	11.2	9. 6	9. 6	9. 6	9. 6
DAYS 11-20	9. 6	9. 6	9. 6	11. 2	11.2	11.2	9. 6	9. 6	6. 4	3. 2
TURBINE 1-10	13.6	16. 7	16. 7	0. 0	16. 7	16. 7	0. 0	0. 0	16. 7	0. 0
UNITS 11-16	0.0	16. 7	16. 7	16. 7	16. 7	16. 7				

METER POS	DIR	SP DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	-1.0	-1	-1.0	2	-1.0	-1. 0	-1	-1.0
3	-1. 0	-1.0	-1	-1. 0	4	-1. 0	-1. 0	-1	-1.0
5	-1. 0	-1.0	-1	-1. 0	6	-1. 0	-1. 0	-1	-1. 0
7	204. 6	13.4	18	0. 7	8	-1.0	-1. 0	-1	-1. 0
9	222. 8	13.3	29	1. 5	10	-1. 0	-1, 0	-1	-1. 0
11	202. 9	13. 3	25	2. 9	12	-1. 0	-1. 0	-1	-1.0
13	316.7	11. 7	20	0. 9	14	206.0	10. 7	24	1. 7
15	205. 2	15.6	33	1. 3	16	207.4	12. 7	21	0. 7
17	203. 2	7. 4	22	0. 6	18	203.5	8. 3	18	1. 7
19	-1. 0	-1.0	-1	-1. 0	20	203.3	9. 1	18	1. 6

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830519	1 3	268. 1	265. 1	2. 4	0. 9	261. 6

SPILL 1-10	0. 0	0 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0
BAYS 11-20	0 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	3. 1
TURBIBNE 1-10	13. 8	18 0	18. 0	18. 0	18. 0	18. 0	18. 0	18. 0	18. 0	18. 0	0. 0
UNITS 11-16	18. 0	18. 0	18. 0	18. 0	18. 0	18. 0					

METER POS	DIR	SP DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1. 0	-1. 0	-1	-1. 0	2	-1.0	-1. 0	-1	-1.0
3	-1.0	-1. 0	-1	-1. 0	4	-1.0	-1.0	-1	-1. 0
5	-1. 0	-1. 0	-1	-1. 0	6	-1.0	-1. 0	-1	-1.0
7	-1.0	-1.0	-1	-1.0	8	-1.0	-1.0	-1	-1. 0
9	-1. 0	-1.0	-1	-1. 0	10	-1. 0	-1. 0	-1	-1. 0
11	-1. 0	-1.0	-1	-1. 0	12	-1. 0	-1. 0	-1	-1. 0
13	208. 1	5. 5	14	0. 6	14	202. 1	7. 6	18	0. 6
15	186. 2	4. 3	11	0. 6	16	208. 3	13. 9	23	1. 0
17	206.8	10. 6	19	0. 7	18	212. 6	5. 1	9	1. 5
19	715.4	9. 0	14	1. 0	20	197.7	8. 3	6	1. 6

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830519	14	281.5	277.7	3.2	1.1	261.6

SPILL 1-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BAYS 11-20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
TURBINE 1-10	13.8	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	0.0
UNITS 11-16	18.3	18.9	18.9	18.9	18.9	18.9				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	-1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	-1.0	-1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	-1.0	-1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	-1.0	-1.0	-1	-1.0	8	-1.0	-1.0	-1	-1.0
9	-1.0	-1.0	-1	-1.0	10	-1.0	-1.0	-1	-1.0
11	-1.0	-1.0	-1	-1.0	12	-1.0	-1.0	-1	-1.0
13	209.9	6.2	20	0.5	14	203.4	9.8	19	0.5
15	186.2	7.9	14	1.1	16	205.3	9.0	19	0.5
17	209.6	8.0	16	1.2	18	204.3	10.5	10	1.4
19	217.2	6.V	13	1.2	20	196.8	6.5	5	0.9

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830519	1 5	278. 7	274.9	3. 2	2. 1	261.5

SP ILL 1-10	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0
BAYS 11-20	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	3. 1
TURBINE 1-10	13. 8	18 7	20. 7	18. 7	28. 7	18. 7	18. 7	18. 7	18. 7	0. 0
UNITS 11-16	18. 7	18. 7	18. 7	18. 7	28. 7	20. 7				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1. 0	-1. 0	- 1	-1. 0	2	-1. 0	-1. 0	−1	-2. 0
3	-1. 0	-2. 0	- 1	-1. 0	4	-1. 0	−1. 0	-1	-1. 0
5	-1. 0	-1. 0	- 1	-1. 0	6	-1. 0	-2. 0	- 1	-1. 0
7	-1. 0	-1. 0	- 1	- 1. 0	8	- 2. 0	-1. 0	- 1	- 1. 0
9	-1. 0	-1. 0	- 1	- 1. 0	10	- 1. 0	- 1. 0	- 1	-1. 0
11	-1. 0	- 1. 0	- 1	-1. 0	12	- 1. 0	-1. 0	−1	-1. 0
13	209. 0	4. 9	i 7	1. 2	14	202. 8	10. 3	18	0. 8
15	193. 8	8. 8	16	1. 0	16	208. 7	12. 5	20	0. 6
17	207. 9	5. 5	16	1. 4	18	200. 1	9. 8	9	1. 3
19	207. 1	9. 7	e	1. 2	20	206. 4	6. 1	9	1. 4

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830519	16	275.2	271.4	3.2	1.2	261.7

SPILL 1-10	0.0	0 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BAYS 11-20	0.0	0 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
TURBINE 1-10	13.8	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	0.0
UNITS 11-16	18.4	18.4	18.4	18.4	18.4	18.4				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	-1.0	-2	-2.0	2	-1.0	-1.0	-1	-2.0
3	-1.0	-1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	-1.0	-1.0	-1	-1.0	6	-2.0	-1.0	-1	-2.0
7	-1.0	-1.0	-1	-1.0	8	-1.0	-1.0	-2	-1.0
9	-1.0	-1.0	-1	-1.0	10	-1.0	-1.0	-1	-1.0
12	-1.0	-1.0	-1	-1.0	12	-1.0	-1.0	-1	-2.0
13	208.9	6.9	15	0.5	14	201.4	8.3	16	0.9
15	196.7	9.7	20	0.7	16	200.1	5.4	14	0.6
17	212.3	6.5	19	0.7	18	203.9	8.4	10	2.2
19	208.5	5.7	8	1.5	20	201.5	8.7	6	1.0

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL,	FOREBAY ELEV.
	830519	17	273.9	270.1	3.2	1.2	261.8

SPILL 1-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GAYS 11-20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
TURBINE 1 1 0	13.8	16 3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	0.0
UN I TS 11-16	18.3	18.3	18.3	18.3	18.3	18.3				

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	-1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	-1.0	-1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	-1.0	-1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	-1.0	1.0	-1	-1.0	8	-1.0	-1.0	-1	-1.0
9	-1.0	-1.0	-1	-1.0	10	-1.0	-1.0	-1	-1.0
11	-1.0	-1.0	-1	-1.0	12	-1.0	-1.0	-1	-1.0
13	210.4	11.5	17	0.9	14	202.3	10.3	18	1.3
15	191.5	4.8	18	1.5	16	211.6	9.8	17	0.9
17	207.9	4.0	15	0.8	18	208.4	11.4	14	0.8
19	212.2	3.2	11	0.7	20	206.1	4.7	8	0.6

JOHN DAY DAM	DATE	HOUR.	RIVER FLOWS * TOTAL	TURBINE	SPILL .*	PERCENT SPILL	FOREBAY ELEV.
	830519	18	280. 4	274. 8	3. 2	I. 1	261. 8

SPILL 1-10	0. 0	0 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0
BAYS 1 1-20	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	0. 0	3. 1
TURBINE 1 -10	18. 3	18 5	18. 5	18. 3	18. 3	18. 3	18. 3	10. 3	18. 3	0. 0	
UNITS 11-16	18. 5	18 3	16. 1	18. 3	18. 3	18. 3					

METER POS	DIR	SD DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1. 0	-1. 0	-1	-1. 0	2	-1. 0	-1. 0	-1	-1. 0
3	-1. 0	-1. 0	-1	-1. 0	4	-1. 0	-1. 0	-1	-1. 0
3	-1. 0	-1.0	-1	-1. 0	6	-1. 0	-1. 0	-1	-1. 0
7	-1. 0	-1. 0	-1	-1. 0	8	-1. 0	-1. 0	-1	-1. 0
9	-1. 0	-1. 0	-1	-1. 0	10	-1. 0	-1. 0	-1	-1. 0
11	-1. 0	-1. 0	-1	-1. 0	12	-1. 0	-1. 0	-1	-1. 0
13	208. 7	12. 7	18	1.2	14	208. 6	13. 2	19	0. 7
13	193. 3	12. 4	25	1. 0	16	203. 1	8. 2	17	1. 0
17	306. 5	11. 8	18	0. 5	18	206.8	7. 0	13	0. 6
19	205.6	6. 9	11	0. 7	20	193.2	7. 2	1	0. 9

JOHN DAY DAM	DATE	HOUR	RIVER FLOWS * TOTAL	TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830519	19	278.8	268.9	9.3	3.3	261.9

SPILL BAYS	1-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1-20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
TURBINE UNITS	1 1 0	18.0	18.G	18.0	18.0	18.0	18.0	18.0	18.0	18.0	0.0
	11-16	18.0	18.0	16.1	18.0	18.0	18.0				

METER POS	DIR	SP DIR	SP VEL	SD VEL	METER POS	DIR	SD DIR	SD VEL	SD VEL
1	-1.0	-1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	1.0	-1.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	-1.0	-1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	-1.0	-1.0	-1	-1.0	8	-1.0	-1.0	-1	-1.0
9	-1.0	-1.0	-1	-1.0	10	-1.0	-1.0	-1	-1.0
11	-1.0	-1.0	-1	-1.0	12	-1.0	-1.0	-1	-1.0
13	713.0	9.1	16	1.2	14	201.5	9.3	20	0.7
15	137.7	8.6	21	0.6	16	208.4	9.9	20	0.9
17	207.4	9.7	19	1.0	18	207.6	7.7	11	1.2
19	217.4	12.5	13	0.7	20	207.9	5.1	1	1.6

JOHN DAY DAM	DATE	HOUR.	* TOTAL	RIVER FLOWS TURBINE	SPILL *	PERCENT SPILL	FOREBAY ELEV.
	830513	20	304.9	161.2	141.3	46.3	261.7

SPILL I-10	1.2	2 3	2.3	2.3	2.3	2.3	2.3	3.5	3.3	0.0
BAYS 1 1-20	0:0	0.0	0.0	0.0	10.4	23.1	23.1	10.4	10.4	11.1
TURBINE I-10	16.1	16.1	16.1	0.0	16.1	0.0	16.1	16.1	16.1	0.0
UNITS 11-16	0.0	16.1	16.2	0.0	0.0	16.1				

METER POS	DIR	SP DIR	VEL	SD VEL	METER POS	DIR	SD DIR	VEL	SD VEL
1	-1.0	-1.0	-1	-1.0	2	-1.0	-1.0	-1	-1.0
3	1.0	--I.0	-1	-1.0	4	-1.0	-1.0	-1	-1.0
5	-1.0	-1.0	-1	-1.0	6	-1.0	-1.0	-1	-1.0
7	-1.0	-1.0	-1	-1.0	8	-1.0	-1.0	-1	-1.0
9	-1.0	-1.0	-1	-1.0	10	-1.0	-1.0	-1	-1.0
11	-1.0	-1.0	-1	-1.0	12	-1.0	-1.0	-1	-1.0
13	210.4	8.7	17	1.2	14	203.4	12.0	21	0.7
15	131.7	12.0	23	1.2	16	204.6	8.5	20	0.9
17	208.9	5.9	20	0.9	18	211.9	5.6	14	0.7
19	216.0	7.1	15	1.3	20	215.0	6.6	10	1.4

APPENDIX C

Radio Tracks--Spring 1983

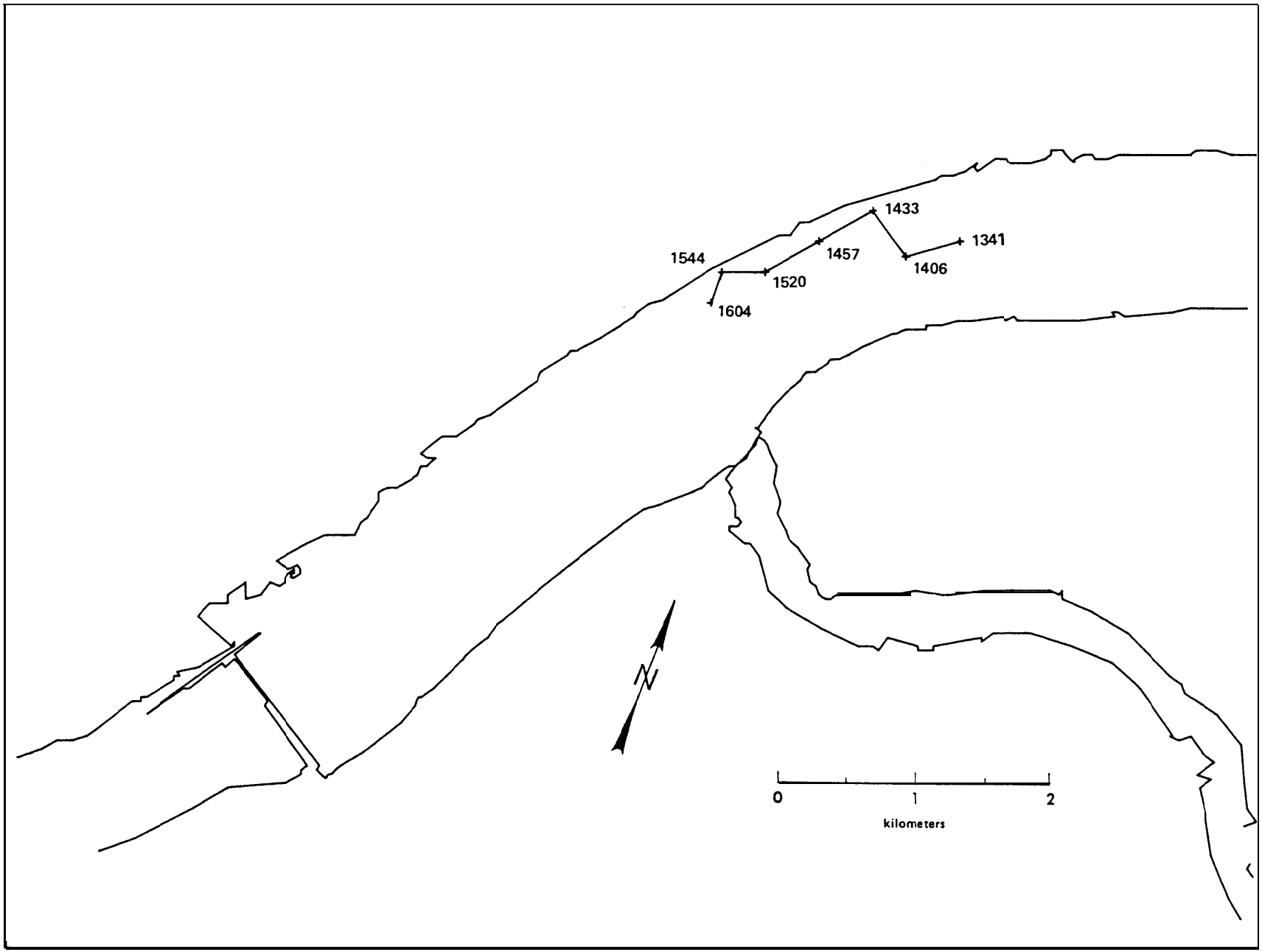
RELEASE DATE: 22 APRIL 1983 INDIVIDUAL FISH CODE: 766

SPECIES: SPRING CHINOOK LENGTH: 170 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:41	179.6	0.0	0						
14:06	191.4	0.0	0	400	0:25	960	237	400	0:25
14:33	191.4	0.0	0	339	0:27	753	305	73Y	0:52
14:57	191.4	0.0	0	459	0:24	1,148	231	1,198	1:16
15:20	188.0	0.0	0	425	0:23	1,109	215	1,623	1:39
15:44	188.0	0.0	0	346	0:24	865	250	1,969	2:03
16:04	199.0	0.0	0	220	0:20	660	172	2,189	2:23

#

This track was made for training purposes. Signal reception was erratic during the track and there was an abrupt end to the signal. Tag failure is believed to have been the reason for losing this fish.


1544
1604
1520
1457
1433
1406
1341
N
0
1
2
kilometers

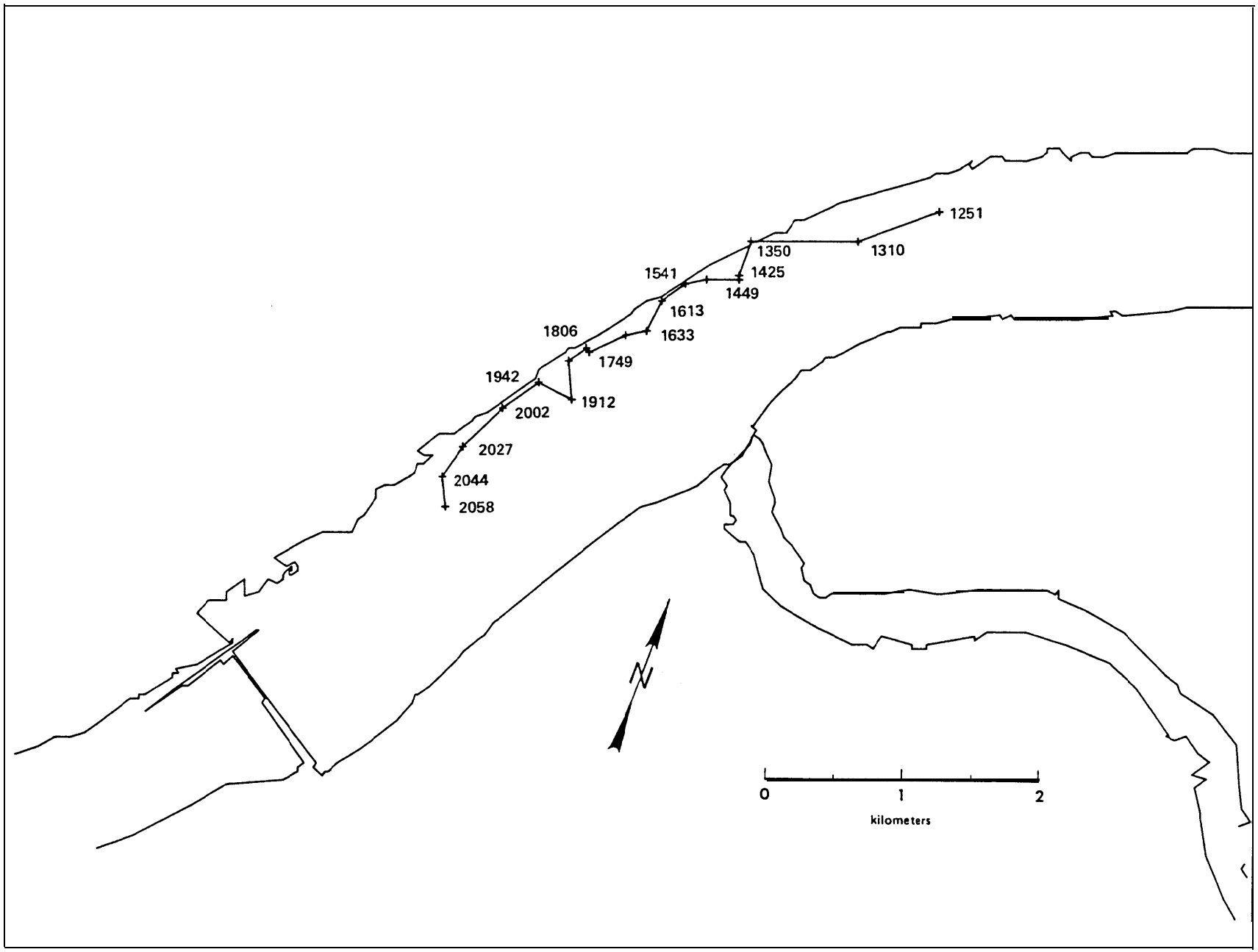
RELEASE DATE: 23 APRIL 1983 INDIVIDUAL FISH CODE: 633

SPECIES: SPRING CHINOOK LENGTH: 150 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
12:51	234.5	120.3	51						
13:10	217.4	120.3	55	623	0:19	1,967	230	623	0: 19
13:50	217.4	120.3	55	778	0:40	1,167	250	1,401	0: 59
14:25	227.5	120.3	53	262	0:35	449	180	1,663	1:34
14:49	227.5	120.3	53	31	0:24	78	160	1,694	1:58
15:20	233.2	120.3	52	238	0:31	461	250	1,932	2:29
15:41	233.2	120.3	52	154	0:21	440	239	2,086	2:50
16:13	246.5	120.3	49	213	0:32	399	215	2,299	3:22
16:33	246.5	120.3	49	242	0:20	726	187	2,541	3:42
16:54	246.5	120.3	49	154	0:21	440	239	2,695	4:03
17:49	241.1	120.3	50	287	0:55	313	225	2,982	4:58
18:06	240.5	120.3	50	38	0:17	134	305	3,020	5:15
18:41	240.5	120.3	50	159	0:35	273	215	3,179	5:50
19:12	259.1	130.8	50	279	0:31	540	156	3,458	6:21
19:42	259.1	130.8	50	268	0:30	536	278	3,726	6:51
20:02	274.7	140.9	51	319	0:20	957	215	4,045	7: 11
20:27	274.7	140.9	51	395	0:25	948	206	4,440	7:36
20:44	274.7	140.9	51	264	0:17	932	195	4,704	7:53
20:58	274.7	140.9	51	217	0:14	930	154	4,921	8:07

#

This fish was the first that delayed at the John Day River plume. It did not move past the plume until after sunset. The signal from this fish was high and low throughout the track, indicating that the fish may have been diving while trying to pass the plume. The track was terminated when weather conditions became bad and the contact with the tag could not be maintained. This fish passed through the spillway on April 26 at 1609.


1251
1350
1310
1541
1425
1449
1613
1806
1633
1749
1942
1912
2002
2027
2044
2058
0
1
2
kilometers

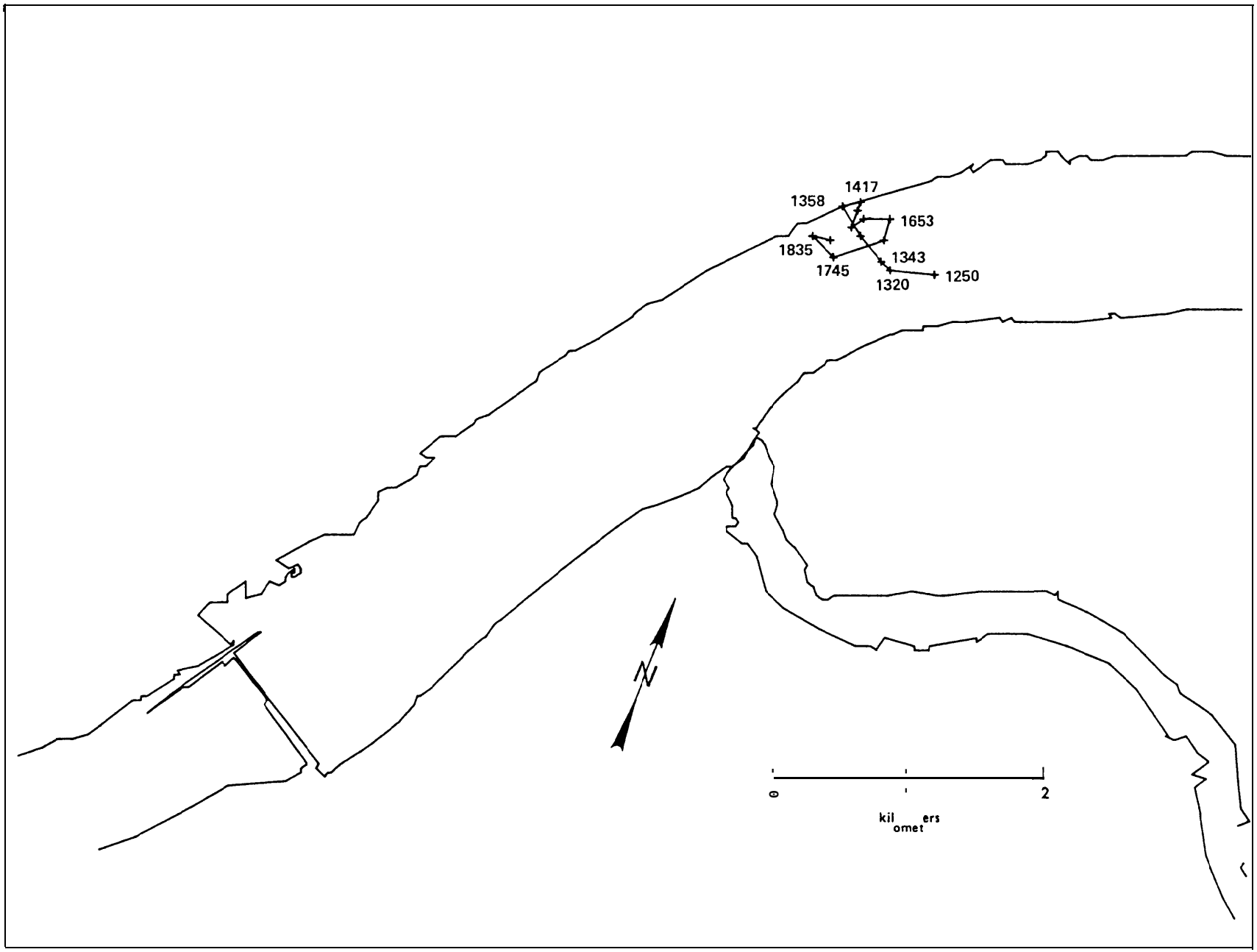
RELEASE DATE: 24 APRIL 1983 INDIVIDUAL FISH CODE: 176

SPECIES: SPRING CHINOOK LENGTH: 148 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
12:50	278.6	134.6	48						
13:20	263.1	134.6	51	326	0:30	652	256	326	0:30
13:43	263.1	134.6	51	90	0:23	235	294	416	0:53
13:58	263.1	134.6	51	239	0:15	956	301	655	1:08
14:17	263.9	134.6	51	252	0:19	796	309	907	1:27
14:36	263.9	134.6	51	133	0:19	420	57	1,040	1:46
14:59	263.9	134.6	51	65	0:23	170	180	1,105	2:09
15:23	268.9	134.6	50	131	0:24	328	180	1,236	2:33
15:50	268.9	134.6	50	106	0:27	236	35	1,342	2:60
16:53	273.6	134.6	49	195	1:03	186	70	1,537	4:03
17:22	274.6	134.6	49	160	0:29	331	176	1,697	4:32
17:45	274.6	134.6	49	388	0:23	1,012	232	2,085	4:55
18:35	271.9	134.6	50	216	0:50	259	296	2,301	5:45
18:56	271.9	134.6	50	133	0:21	380	84	2,434	6:06

#

This fish track was terminated when the fish did not move downstream into the area that would supply information to the forebay data pool. With no lights on the navigation markers above the John Day River, we could not fix the tags location after sunset.


1417
1358
1653
1835
1343
1745
1250
1320
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kil ers
omet

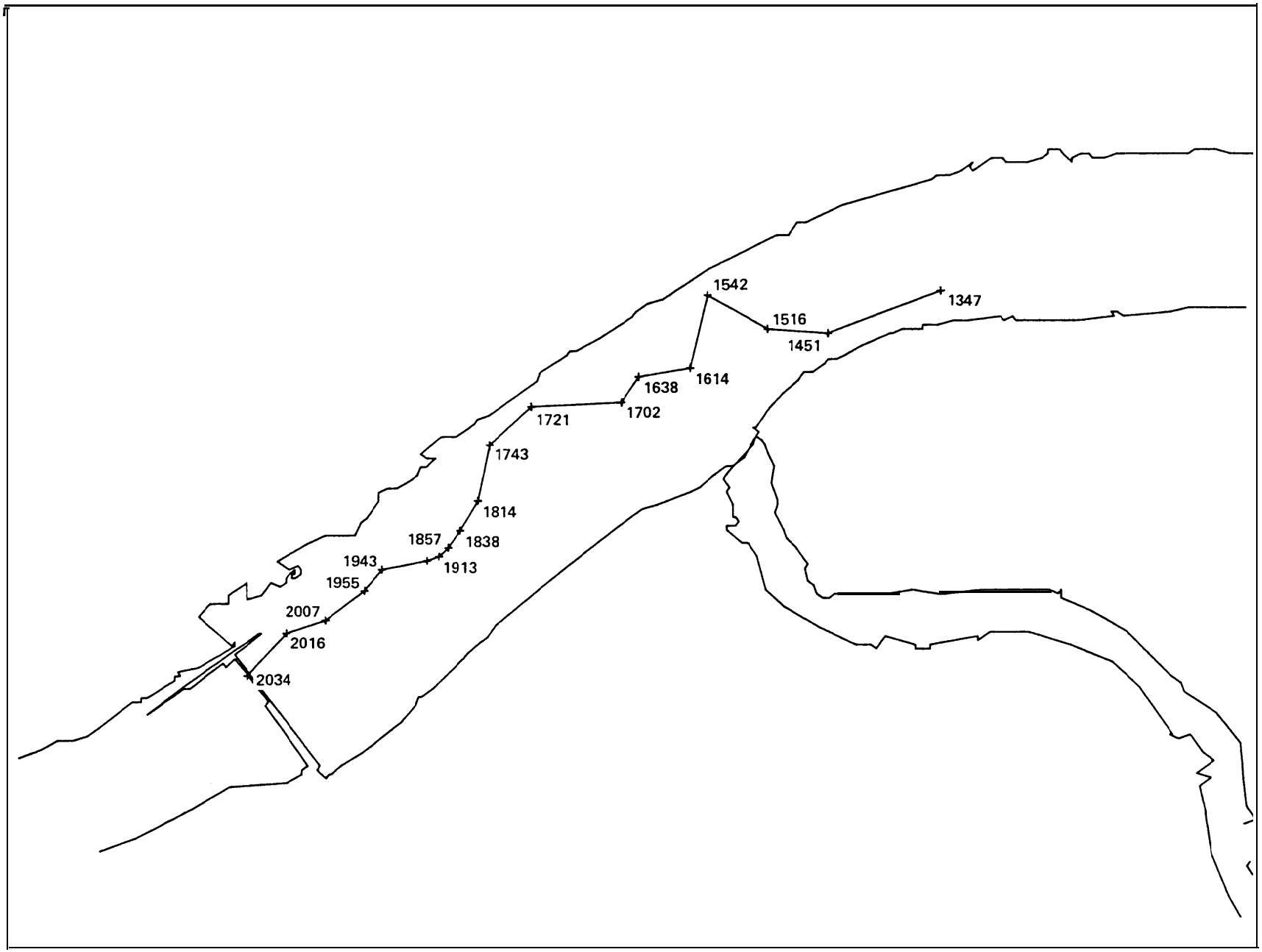
RELEASE DATE: 26 APRIL 1983 INDIVIDUAL FISH CODE: 677

SPECIES: SPRING CHINOOK LENGTH: 158 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:47	351.5	178.9	51						
14:51	348.8	204.0	58	878	1:04	823	230	878	1:04
15:16	345.0	212.4	62	434	0:25	1,042	254	1,312	1:29
15:42	345.0	212.4	62	498	0:26	1,149	280	1,810	1:55
16:14	350.2	218.5	62	541	0:32	1,014	174	2,351	2:27
16:38	350.2	218.5	62	373	0:24	933	241	2,724	2:51
17:02	353.0	200.5	57	226	0:24	565	195	2,950	3:15
17:21	353.0	200.5	57	649	0:19	2,049	247	3,599	3:34
17:43	353.0	200.5	57	411	0:22	1,121	208	4,010	3:56
18:14	348.7	178.0	51	410	0:31	794	172	4,420	4:27
18:38	348.7	178.0	51	252	0:24	630	191	4,672	4:51
18:57	348.7	178.0	51	151	0:19	477	195	4,823	5:10
19:13	351.5	177.3	50	90	0:16	338	207	4,913	5:26
19:28	351.5	177.3	50	92	0:15	368	231	5,005	5:41
19:43	351.5	177.3	50	330	0:15	1,320	239	5,335	5:56
19:55	351.5	177.3	50	202	0:12	1,010	200	5,537	6:08
20:07	347.2	174.6	50	355	0:12	1,775	213	5,892	6:20
20:16	347.2	174.6	50	296	0:09	1,973	232	6,188	6:29
20:34	347.2	174.6	50	417	0:18	1,390	203	6,605	6:47

#

During this track the John Day River plume did not reach accross the Columbia River to the Washington side. The only slow movement was just above the restricted zone before sunset. The fish was tracked to Spillgate number 10 where the signal was lost. The spillway monitors last recorded the tag at 2035.


1542
1347
1516
1451
1614
1638
1702
1721
1743
1814
1857
1838
1913
1943
1955
2007
2016
2034

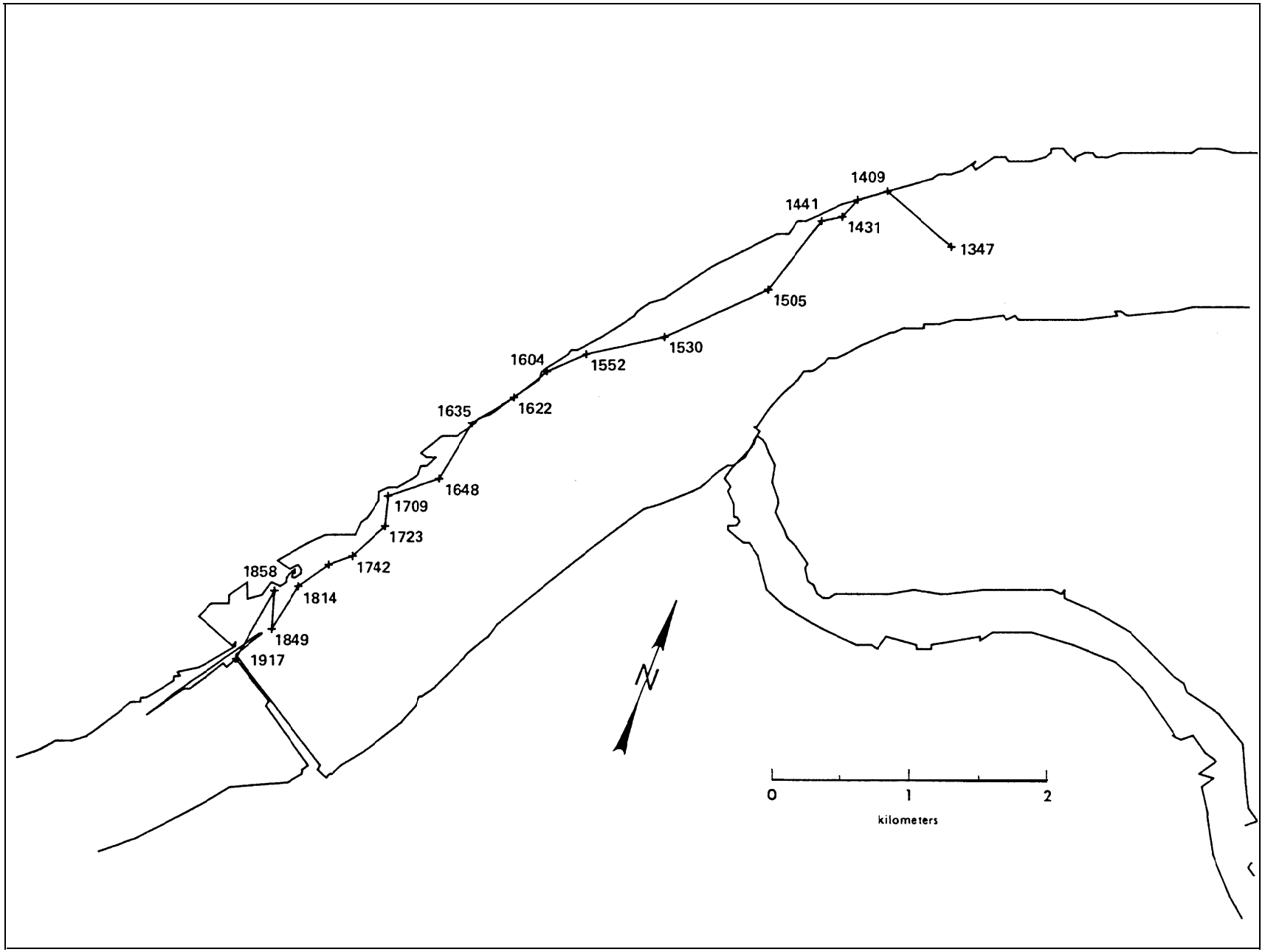
RELEASE DATE: 27 APRIL 1983 INDIVIDUAL FISH CODE: 278

SPECIES: SPRING CHINOOK LENGTH: 160 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:47	345.7	209.8	61						
14:09	352.1	207.8	59	606	0:22	1,653	292	606	0:22
14:17	352.1	2157.8	59	225	0:08	1,688	234	831	0:30
14:31	352.1	207.8	59	164	0:14	703	201	995	0:44
14:41	352.1	207.8	59	154	0:10	924	239	1,149	0:54
15:05	345.1	214.0	62	629	0:24	1,573	198	1,778	1:18
15:30	345.1	214.0	62	829	0:25	1,990	226	2,607	1:43
15:52	345.1	214.0	62	576	0:22	1,571	238	3,183	2:05
16:04	343.7	184.6	54	307	0:12	1,535	226	3,490	2:17
16:22	343.7	184.6	54	301	0:18	1,003	212	3,791	2:35
16:35	343.7	184.6	54	355	0:13	1,638	219	4,146	2:48
16:48	343.7	184.6	54	466	0:13	2,151	191	4,612	3:01
17:09	351.0	175.7	50	388	0:21	1,109	232	5,000	3:22
17:23	351.0	175.7	50	217	0:14	930	166	5,217	3:36
17:42	351.0	175.7	50	321	0:19	1,014	208	5,538	3:55
17:57	351.0	175.7	50	184	0:15	736	231	5,722	4:10
18:14	351.6	175.7	50	266	0:17	939	215	5,988	4:27
18:49	351.6	175.7	50	365	0:35	626	192	6,353	5:02
18:58	351.6	175.7	50	279	0:09	1,860	345	6,632	5:11
19:17	355.5	176.0	50	568	0:19	1,794	190	7,200	5:30

#

This fish moved downstream with little delay until it got to the outfall from the aluminum plant. After a short time there, it moved to the area just above the restricted zone where it slowed down again. When the fish moved closer to the spillway it changed direction moving toward the Washington shore and upstream. Just before sunset the fish moved to the spillway and was last heard at Spillgate number 1. The last record on the spill monitor was at 1912.


1409
1441
1431
1347
1505
1530
1604
1552
1635
1622
1648
1709
1723
1742
1858
1814
1849
1917
N
0
1
2
kilometers

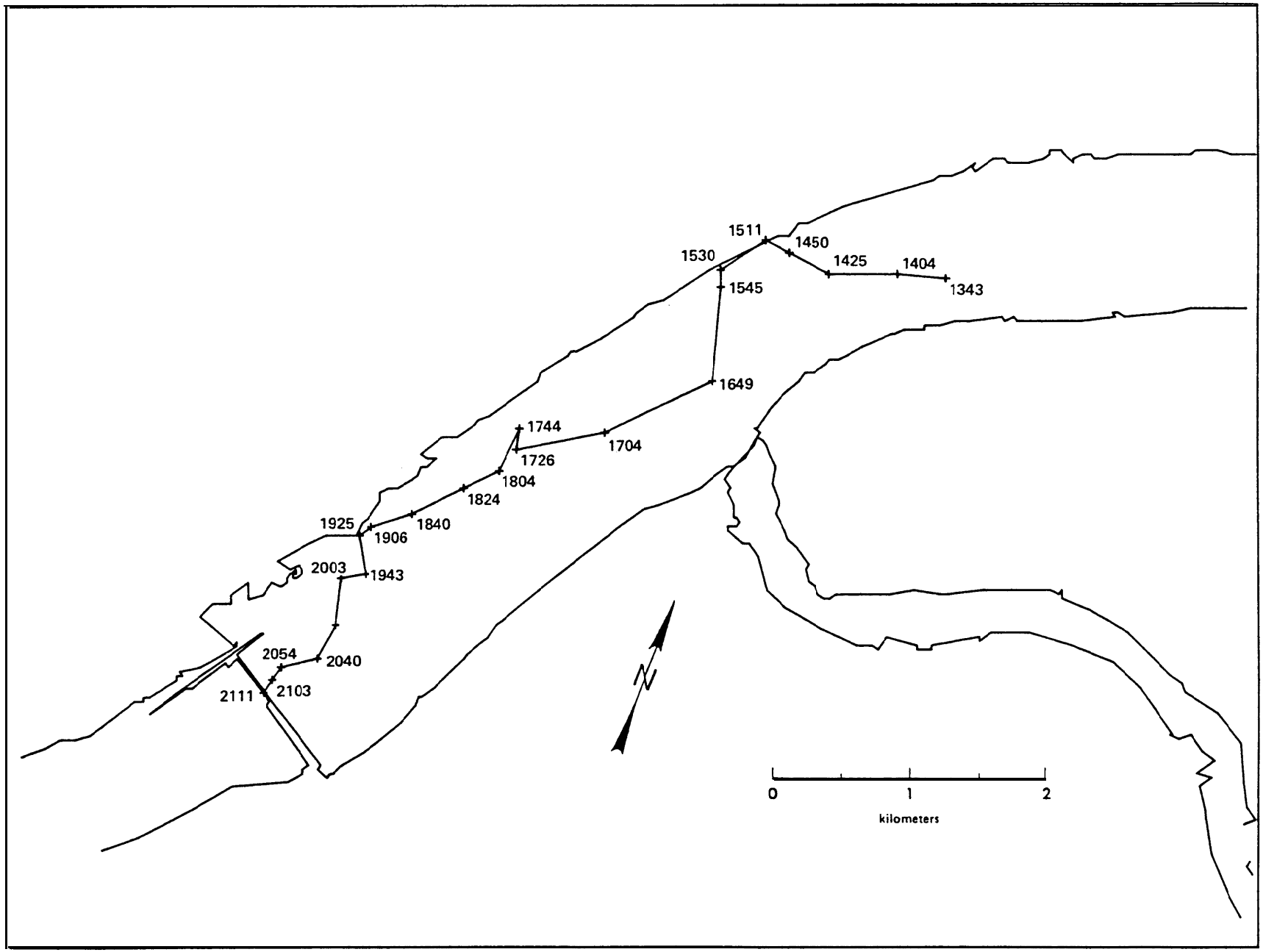
RELEASE DATE: 4 MAY 1983 INDIVIDUAL FISH CODE: 977

SPECIES: SPRING CHINOOK LENGTH: 149 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:43	345.8	120.3	35						
14:04	321.5	120.3	37	347	0:21	991	255	347	0:21
14:25	321.5	120.3	37	497	0:21	1,420	250	844	0:42
14:50	321.5	120.3	37	321	0:25	770	279	1,165	1:07
15:11	308.6	120.3	39	196	0:21	560	278	1,361	1:28
15:30	308.6	120.3	39	390	0:19	1,232	217	1,751	1:47
15:45	308.6	120.3	39	123	0:15	492	160	1,874	2:02
16: 49	286.4	120.3	42	682	1:04	639	166	2,556	3:06
17:04	282.9	120.3	43	862	0:15	3,448	225	3,418	3:21
17:26	282.9	120.3	43	639	0:22	1,743	23Y	4,057	3:43
17:44	282.9	120.3	43	156	0:18	520	348	4,213	4:01
18:05	266.8	120.3	45	344	0:21	983	186	4,557	4:22
18:24	266.8	120.3	45	287	0:19	906	225	4,844	4:41
18:40	266.8	120.3	45	412	0:16	1,545	223	5,256	4:57
19: 06	298.8	149.1	50	317	0:26	732	233	5,573	5:23
19:25	298.8	149.1	50	106	0:19	335	215	5,679	5:42
19:43	298.8	149.1	50	281	0:18	937	151	5,960	6:00
20:03	342.6	169.4	49	176	0:20	528	240	6,136	6:20
20:26	342.6	169.4	49	342	0:23	892	167	6,478	6:43
20:40	342.6	169.4	49	279	0:14	1,196	188	6,757	6:57
20:54	342.6	169.4	49	267	0:14	1,144	237	7,024	7:11
21:03	298.0	150.4	50	113	0:09	753	195	7,137	7:20
21:11	298.0	150.4	50	113	0:08	848	195	7,250	7:28

#

This fish moved to the Washington shore before reaching the John Day River plume. As it continued downstream it approached the plume but did not enter it. The tracking range for the tag was very short. The fish was tracked to Spillgate number 19.


1511
1450
1530
1425
1404
1545
1343
1649
1744
1704
1726
1804
1824
1925
1840
1906
2003
1943
2054
2040
2111
2103
N
0
1
2
kilometers

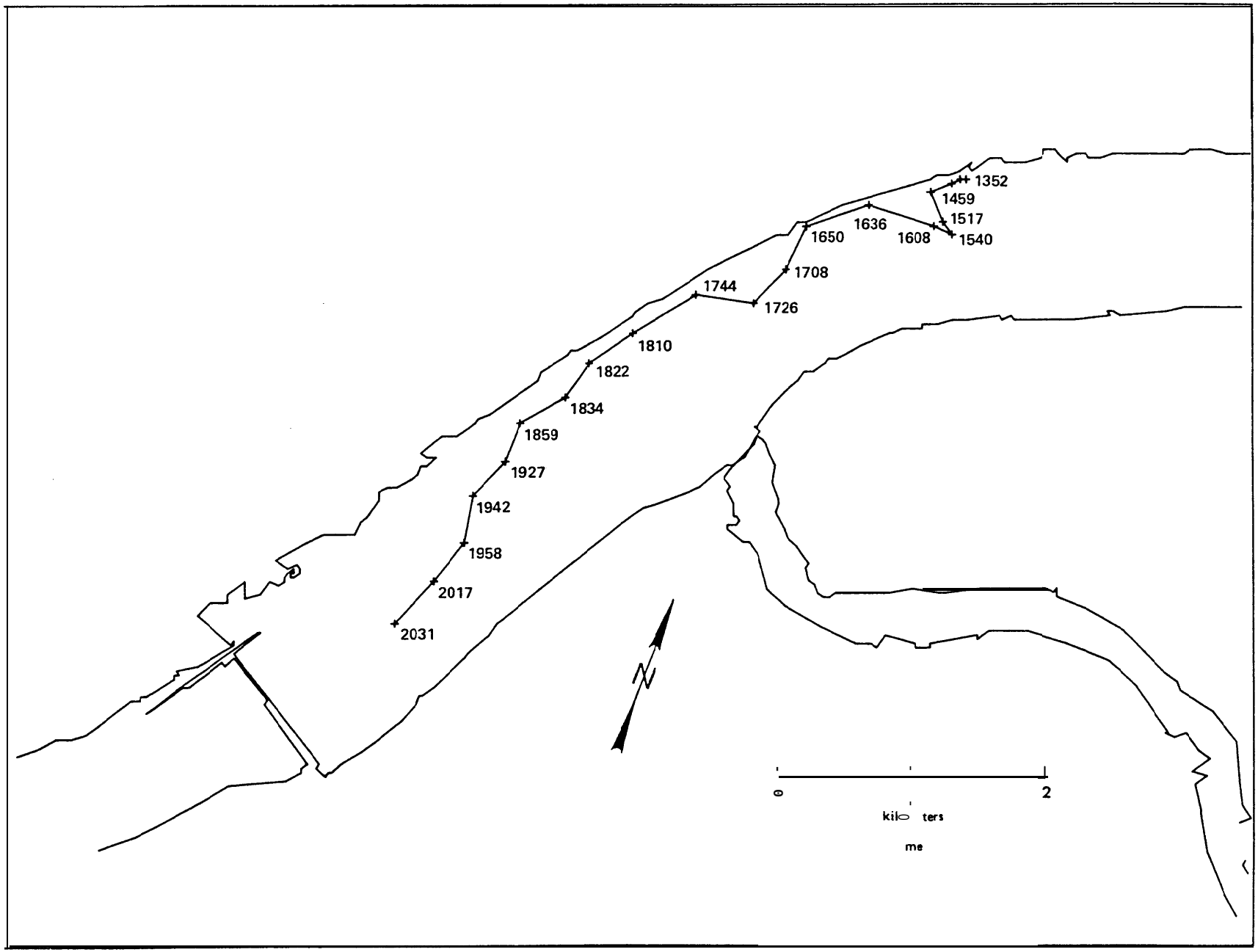
RELEASE DATE: 6 MAY 1983 INDIVIDUAL FISH CODE: 876

SPECIES: SPRING CHINOOK LENGTH: 155 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:52	305.7	80.9	26						
14:08	312.8	121.6	39	43	0:16	161	250	43	0:16
14:40	312.8	121.6	39	72	0:32	135	225	115	0:48
14:59	312.8	121.6	39	163	0:19	515	228	278	1:07
15:17	309.6	152.9	49	233	0:18	777	138	511	1:25
15:40	309.6	152.9	49	113	0:23	295	125	624	1:48
16:08	313.0	156.7	50	144	0:28	309	276	768	2:16
16:36	313.0	156.7	50	500	0:28	1,071	268	1,268	2:44
16:50	313.0	156.7	50	480	0:14	2,057	231	1,748	2:58
17:08	322.7	156.7	49	344	0:18	1,147	186	2,092	3:16
17:26	322.7	156.7	49	343	0:18	1,143	204	2,435	3:34
17:44	322.7	156.7	49	415	0:18	1,383	259	2,850	3:52
18:10	331.1	156.7	47	532	0:26	1,228	219	3,382	4:18
18:22	331.1	156.7	47	390	0:12	1,950	217	3,772	4:30
18:34	331.1	156.7	47	301	0:12	1,505	195	4,073	4:42
18:59	331.1	156.7	47	373	0:25	895	220	4,446	5:07
19:27	370.9	183.0	4Y	298	0:28	63Y	181	4,744	5:35
19:42	370.9	183.0	49	343	0:15	1,372	204	5,087	5:50
19:58	370.9	183.0	49	346	0:16	1,298	171	5,433	6:06
20:17	377.4	185.2	49	352	0:19	1,112	198	5,785	6:25
20:31	377.4	185.2	49	417	0:14	1,787	203	6,202	6:39

#

As this track progressed the weather got worse. At the time the fish approached the restricted zone it was almost dark. The fish appeared to sound and the signal was lost. The track was terminated after an unsuccessful search. Passage through the spill was recorded on the spillway monitor (0346, 8 May).


1352
1459
1517
1540
1608
1636
1650
1708
1726
1744
1810
1822
1834
1859
1927
1942
1958
2017
2031
0
2
kilo ters
me

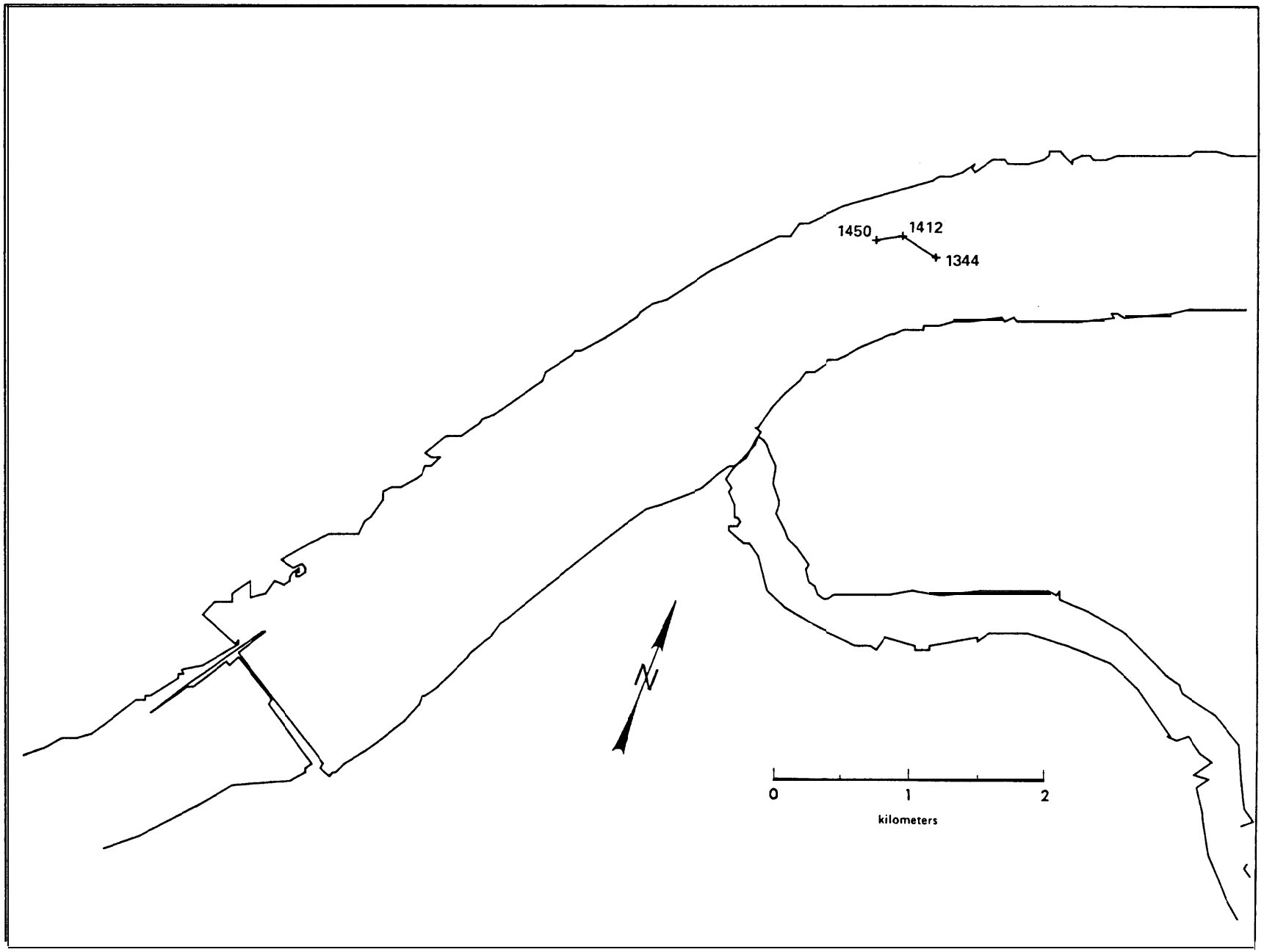
RELEASE DATE: 8 MAY 1983 INDIVIDUAL FISH CODE: 735

SPECIES: SPRING CHINOOK LENGTH: 154 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:44	330.1	120.3	36						
14:12	324.9	154.0	47	284	Ø:28	609	283	284	Ø:28
14:5Ø	324.9	154.0	47	197	Ø:38	311	241	481	1:Ø6

#

During this track the battery on the large boat quit. After repairing the problem a storm moved into the area and the track was terminated because of rough water. Passage at the dam was recorded on 9 May at 2000 by the spillway monitors.


1450
1412
1344
0
1
2
kilometers

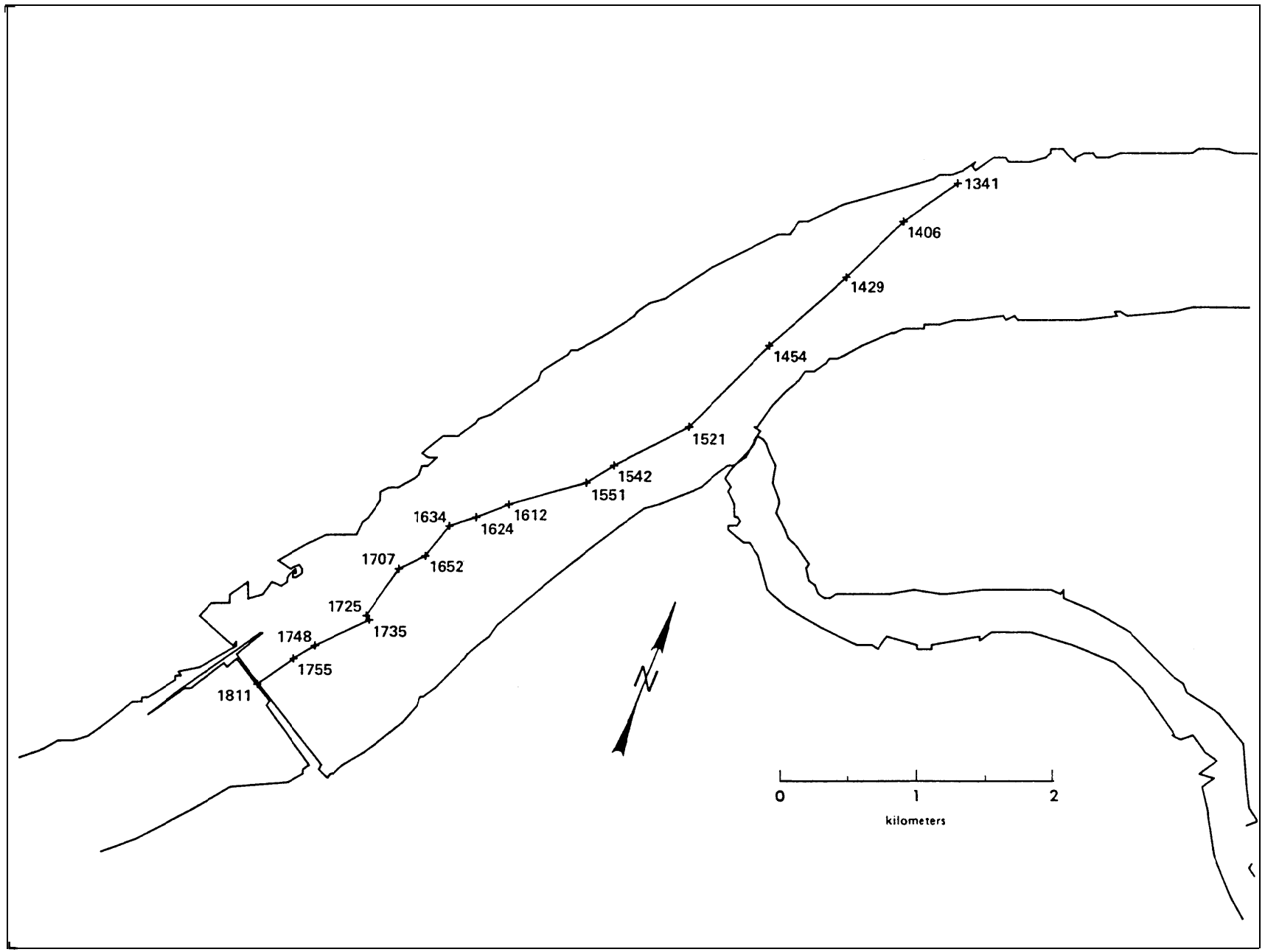
RELEASE DATE: 7 MAY 1983 INDIVIDUAL FISH CODE: 372

SPECIES: SPRING CHINOOK LENGTH: 150 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:41	329.4	199.3	61						
14:06	344.7	195.1	57	478	0:25	1,147	215	478	0:25
14:29	344.7	195.1	57	574	0:23	1,497	206	1,052	0:48
14:54	344.7	195.1	57	748	0:25	1,795	209	1,800	1:13
15:21	340.9	198.Q	58	828	0:27	1,840	205	2,628	1:40
15:42	340.9	198.0	58	608	0:21	1,737	223	3,236	2:01
15:51	3413.9	198.0	58	230	0:09	1,533	218	3,466	2:10
16:12	333.6	175.3	53	583	0:21	1,666	235	4,049	2:31
16:24	333.6	175.3	53	255	0:12	1,275	229	4,304	2:43
16:34	333.6	175.3	53	204	0:10	1,224	233	4,508	2:53
16:52	333.6	175.3	53	277	0:18	923	199	4,785	3:11
17:07	334.Q	171.0	51	216	0:15	864	225	5,001	3:26
17:25	334.0	171.0	51	415	0:18	1,383	195	5,416	3:44
17:35	334.0	171.0	51	38	0:10	228	125	5,454	3:54
17:48	334.0	171.0	51	431	0:13	1,989	225	5,885	4:07
17:55	334.0	171.0	51	177	0:07	1,517	219	6,062	4:14
18:11	341.9	162.0	47	319	0:16	1,196	215	6,381	4:30

#

During this track the wind was out of the northwest. This pushed the John Day River plume up to the Oregon side of the river. When the fish encountered the plume the signal was lost for a short period, indicative of diving behavior. The only slow movement was taking place just upstream from the restricted zone and from there the fish moved to the spillway for a daylight passage through Gate number 14. The spillway monitors last recorded the signals at 1814.


1341
1406
1429
1454
1521
1542
1551
1612
1624
1634
1652
1707
1725
1735
1748
1755
1811
N
0
1
2
kilometers

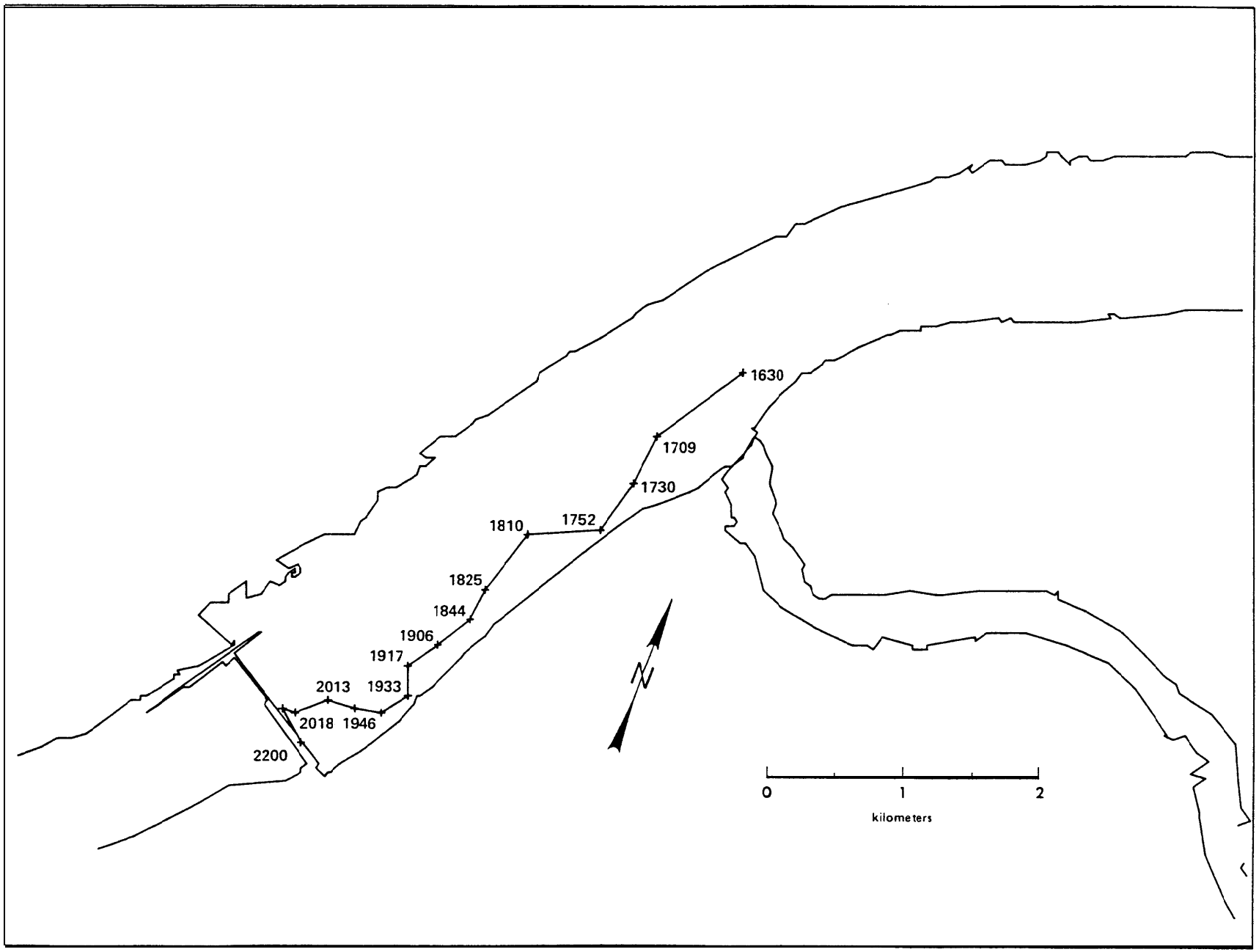
RELEASE DATE: 10 MAY 1983 INDIVIDUAL FISH CODE: 364

SPECIES: SPRING CHINOOK LENGTH: 155 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
16:30	334.2	120.3	36						
17:09	336.6	120.3	36	779	0: 39	1,198	214	779	0:39
17:30	336.6	120.3	36	381	0:21	1,089	187	1,160	1:00
17:52	336.6	120.3	36	415	0:22	1,132	195	1,575	1:22
18:10	337.8	120.0	36	520	0:18	1,733	247	2,095	1:40
18:25	337.8	120.0	36	503	0:15	2,012	197	2,598	1:55
18:44	337.8	120.Q	36	242	0:19	764	187	2,840	2:14
19: 06	378.2	146.4	39	301	0:22	821	212	3,141	2:36
19:17	378.2	146.4	39	266	0: 11	1,451	215	3,407	2:47
19:33	378.2	146.4	39	216	0:16	810	160	3,623	3:03
19:46	378.2	146.4	39	230	0:13	1,062	218	3,853	3:16
19:55	378.2	146.4	39	197	0: 09	1,313	259	4,050	3:25
20:13	418.2	148.8	36	204	0:18	680	268	4,254	3:43
20:18	418.2	148.8	36	255	0:05	3,060	229	4,509	3:48
20:35	418.2	148.8	36	92	0:17	325	270	4,601	4:05
22:00	360.7	148.8	41	279	1:25	197	132	4,880	5:30

#

This fish was released just upstream of the John Day River plume to observe behavior in the plume. Upon entering the plume the signal became weak and was hard to follow. We believe that the fish stayed deep throughout the track. The signal was lost for several short periods in the restricted zone. The last tracking contact with this fish was at Turbine 13 at 2025, but the powerhouse monitors last recorded the signal at 2218 and the fish was recovered from the airlift Turbine Unit 3, during the 2200 sample.


1630
1709
1730
1752
1810
1825
1844
1906
1917
2013
1933
2018
1946
2200
0
1
2
kilometers

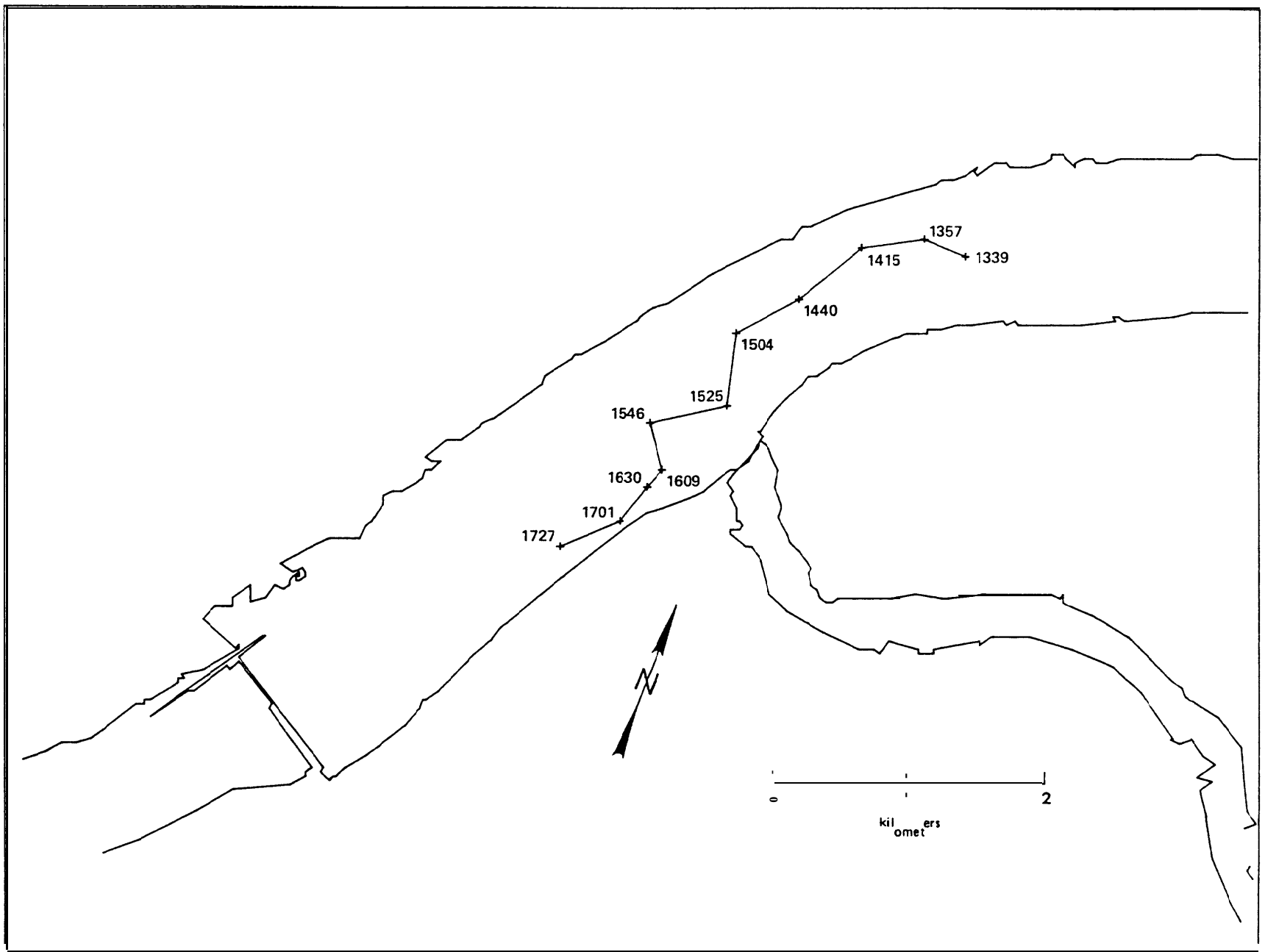
RELEASE DATE: 11 MAY 1983 INDIVIDUAL FISH CODE: 270

SPECIES: SPRING CHINOOK LENGTH: 165 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DiRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:39	335.5	150.4	45						
13:57	335.5	150.4	45	327	0:18	1,090	272	327	0:18
14:15	355.2	150.4	42	458	0:18	1,527	242	785	0:36
14:40	355.2	1513.4	42	586	0:25	1,406	211	1,371	1:01
15:04	343.5	150.4	44	517	0:24	1,293	222	1,888	1:25
15:25	343.5	150.4	44	529	0:21	1,511	167	2,417	1:46
15:46	343.5	150.4	44	576	0:21	1,646	238	2,993	2:07
16:09	347.0	150.4	43	350	0:23	913	145	3,343	2:30
16:30	347.0	150.4	43	164	0:21	469	201	3,507	2:51
17:01	348.3	150.4	43	314	0:31	608	198	3,821	3:22
17:27	348.3	150.4	43	470	0:26	1,085	227	4,291	3:48

#

Upon release this fish moved toward the John Day River. The plume was visible only near the Oregon shore. As the fish moved downstream from the John Day River, its movements slowed and the signal began to fluctuate. At 1727 the signal was lost and the track was terminated after an unsuccessful search.


1357
1415
1339
1440
1504
1525
1546
1630
1609
1701
1727
N
0
2
kilometers

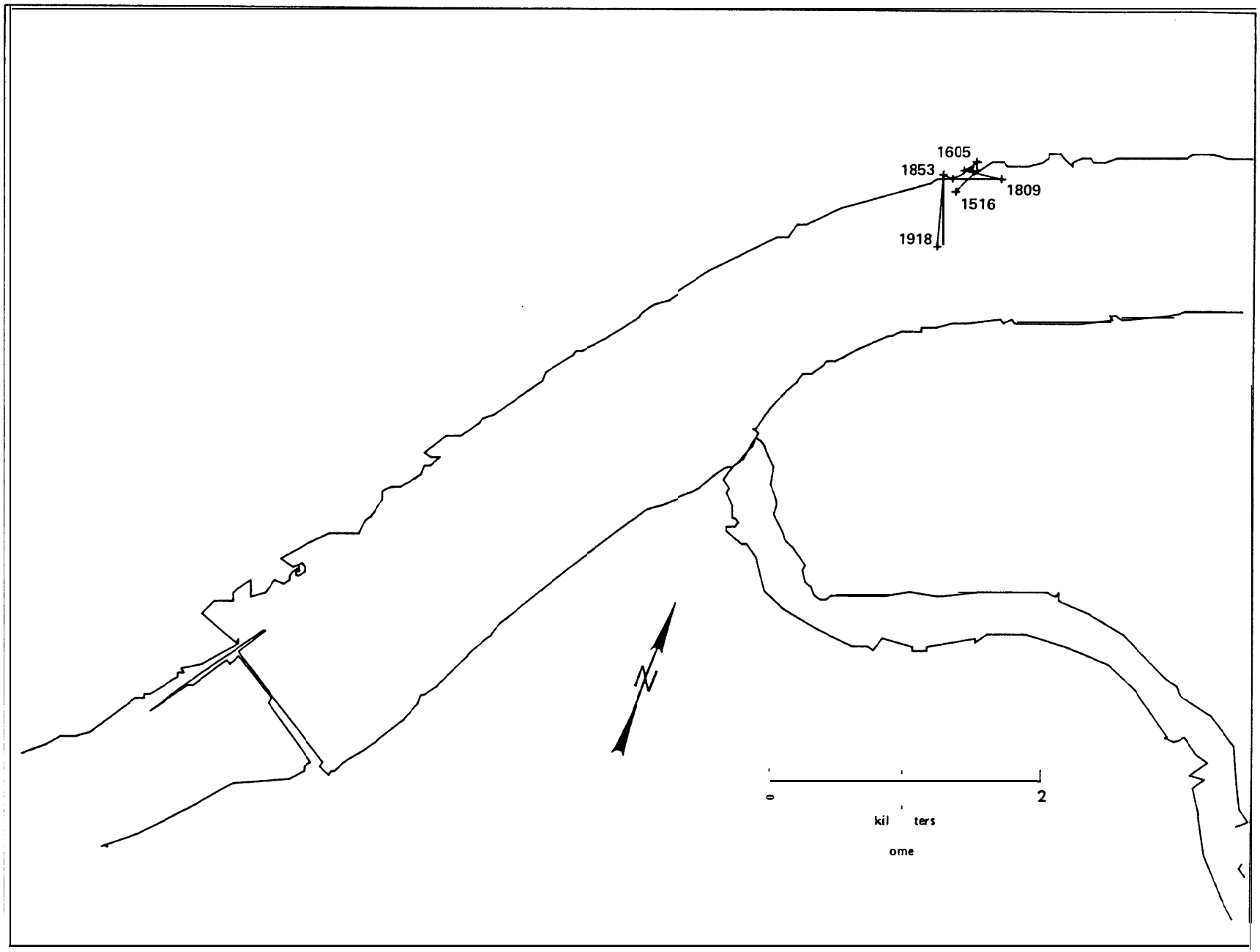
RELEASE DATE: 17 MAY 1983 INDIVIDUAL FISH CODE: 515

SPECIES: SPRING CHINOOK LENGTH: 177 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
15:16	190.3	3.2	2						
15:37	190.3	3.2	2	216	0:21	617	25	216	0:21
16:05	193.3	3.2	2	62	0:28	133	340	278	0:49
16:30	193.3	3.2	2	0	0:25	0	-*-	278	1:14
17:04	197.7	3.2	2	106	0:34	187	215	384	1:48
17:40	197.7	3.2	2	267	0:36	445	84	651	2:24
18:09	197.3	3.2	2	0	0:29	0	-*-	651	2:53
18:32	197.3	3.2	2	346	0:23	903	250	997	3:16
18:53	197.3	3.2	2	72	0:21	206	276	1,069	3:37
19: 18	260.7	122.1	47	527	0:25	1,265	165	1,596	4:02

#

This fish did not move during daylight hours. As the sun set it made one significant move, the signal decreased and the fish was lost. The track was terminated after an unsuccessful search.


1605
1853
1809
1516
1918
0
2
kil ters
ome

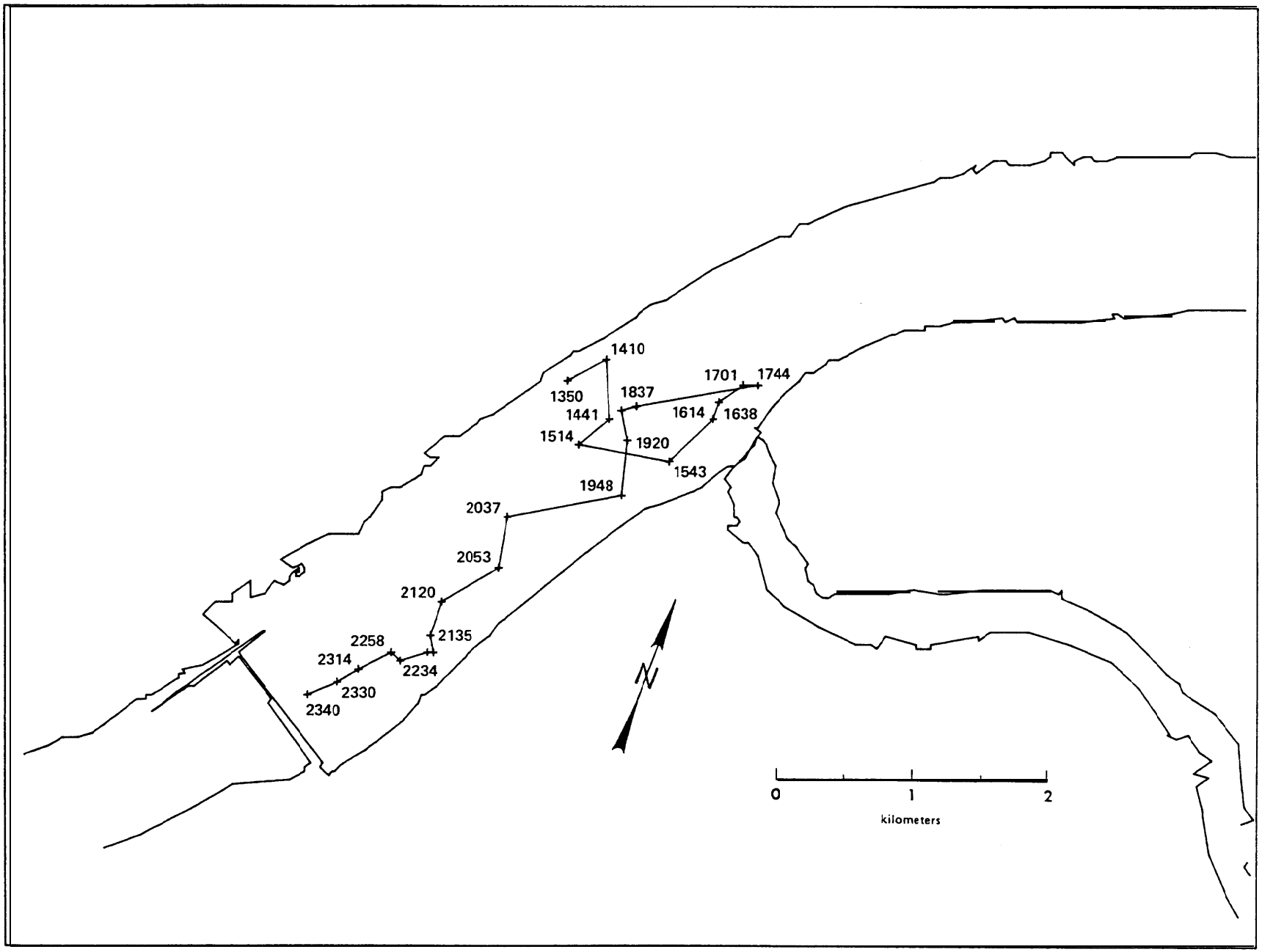
RELEASE DATE: 18 MAY 1983 INDIVIDUAL FISH CODE: 746

SPECIES: SPRING CHINOOK LENGTH: 162 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAC)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:50	249.5	3.2	1						
14:10	236.3	3.2	1	321	0:20	963	41	321	0:20
14:41	236.3	3.2	1	433	0:31	838	157	754	0:51
15:14	219.2	3.2	1	285	0:33	518	210	1,039	1:24
15:43	219.2	3.2	1	660	0:29	1,366	81	1,699	1:53
16:14	245.9	3.2	1	448	0:31	867	27	2,147	2:24
16:38	245.9	3.2	1	131	0:24	328	360	2,278	2:48
17:01	249.4	3.2	1	213	0:23	556	35	2,491	3:11
17:44	249.4	3.2	1	108	0:43	151	70	2,599	3:54
18:37	242.2	3.4	1	900	0:53	1,019	240	3,499	4:47
19:02	278.0	124.5	45	112	0:25	269	234	3,611	5:12
19: 20	278.0	124.5	45	220	0:18	733	149	3,831	5:30
19: 48	278.0	124.5	45	404	0:28	866	166	4,235	5:58
20:37	316.6	153.5	48	836	0:49	1,024	240	5,071	6:47
20:53	316.6	153.5	48	376	0:16	1,410	170	5,447	7:03
21:20	331.5	164.7	50	479	0:27	1,064	219	5,926	7:30
21:35	331.5	164.7	50	262	0:15	1,048	180	6,188	7:45
21:50	331.5	164.7	50	125	0:15	500	150	6,313	8:00
22:23	311.7	157.7	51	43	0:33	78	250	6,356	8:33
22:34	311.7	157.7	51	204	0:11	1,113	233	6,560	8:44
22:58	311.7	157.7	51	90	0:24	225	294	6,658	9:08
23:14	281.4	144.4	51	268	0:16	1,005	223	6,918	9:24
23:30	281.4	144.4	51	177	0:16	664	219	7,095	9:40
23:40	281.4	144.4	51	235	0:10	1,410	227	7,330	9:50

#

Because of a northwest wind this fish was released closer to the dam and near the Washington shore. The signal was lost for short periods of time during the track. Wave action may have forced the fish to move deeper then normal and because of the wind the boats had to move continually to stay with the fish. This is the second fish that was lost in the restricted zone as it approached the dam after dark.


1410
1350
1837
1701
1744
1441
1614
1638
1514
1920
1543
1948
2037
2053
2120
2135
2258
2314
2234
2330
2340
N
0
1
2
kilometers

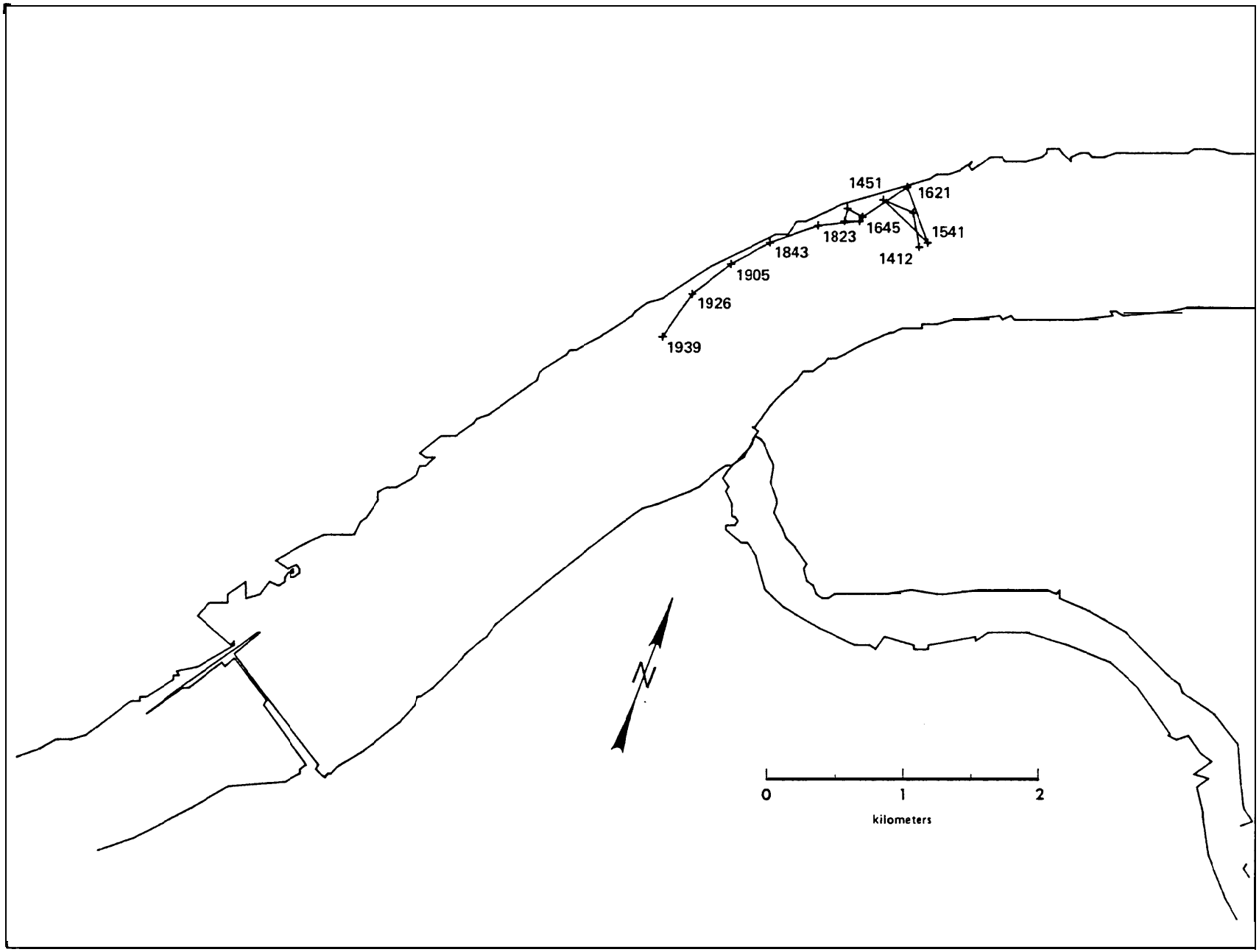
RELEASE DATE: 19 MAY 1983 INDIVIDUAL FISH CODE: 474

SPECIES: SPRING CHINOOK LENGTH: 162 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
14:12	278.7	3.2	1						
14:36	278.7	3.2	1	251	0:24	628	330	251	0:24
14:51	278.7	3.2	1	235	0:15	940	273	486	0:39
15:41	275.2	3.2	1	448	0:50	538	114	934	1: 29
16:21	273.9	3.2	1	429	0:40	644	320	1,363	2:09
16:45	273.9	3.2	1	390	0:24	975	217	1,753	2:33
17:11	280.4	3.2	1	124	0:26	286	280	1,877	2:59
17:36	280.4	3.2	1	95	0:25	228	173	1,972	3:24
18: 09	278.8	9.3	3	108	0:33	196	70	2,080	3:57
18:23	278.8	9.3	3	304	0:14	1,303	244	2,384	4:11
18:43	278.8	9.3	3	367	0:20	1,101	231	2,751	4:31
19:05	304.9	141.3	46	321	0:22	875	221	3,072	4:53
19:26	304.9	141.3	46	355	0:21	1,014	213	3,427	5:14
19: 39	304.9	141.3	46	377	0:13	1,740	195	3,804	5:27

#

This fish held up near the release area for two hours after release, and when it did start to move it was eaten by a seagull. In the four years of juvenile tracking at John Day Dam, this is the second fish that seagulls are known to have taken.


1451
1621
1645
1823
1541
1843
1412
1905
1926
1939
N
0
1
2
kilometers

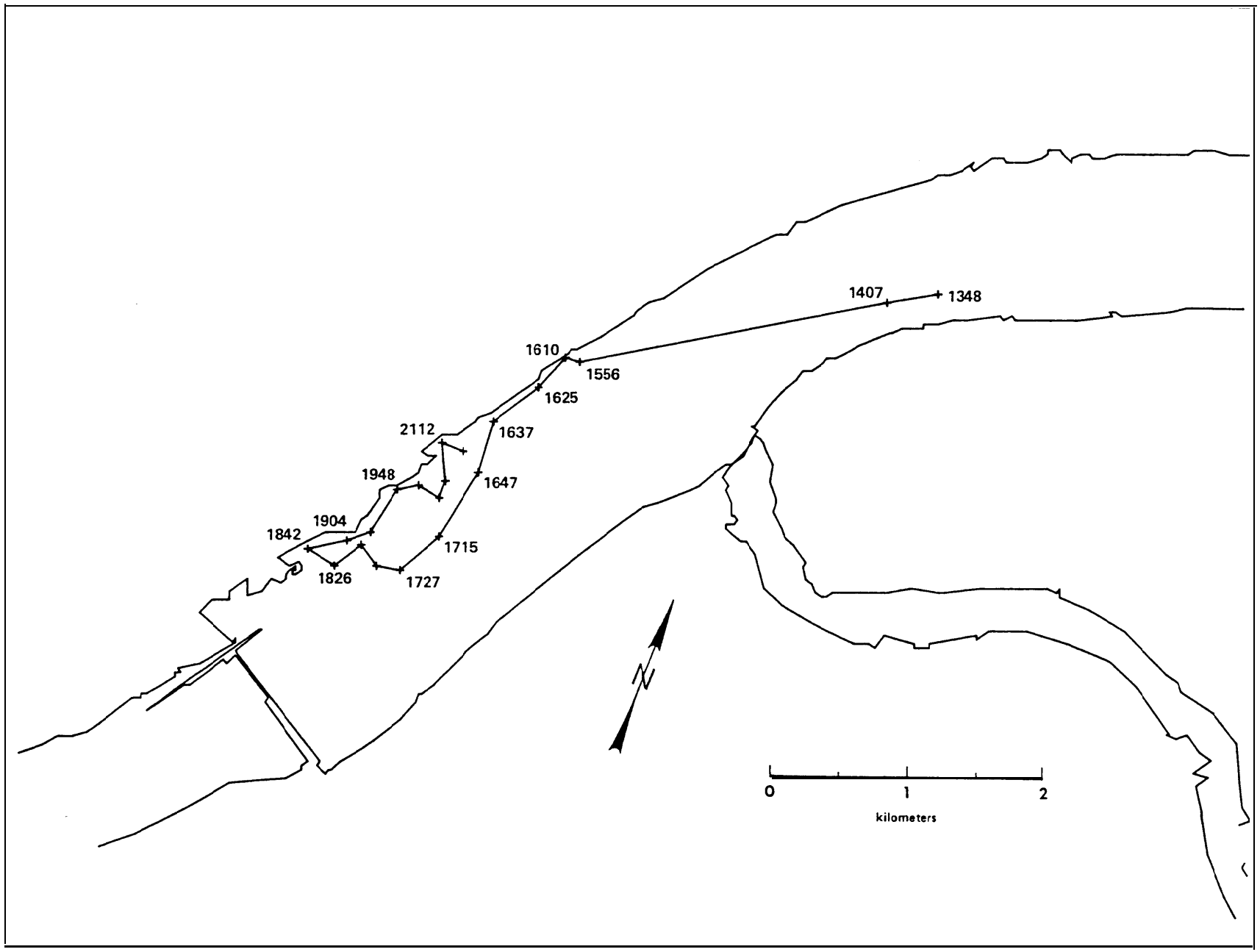
RELEASE DATE: 20 MAY 1983 INDIVIDUAL FISH CODE: 127

SPECIES: SPRING CHINOOK LENGTH: 164 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:48	286.8	3.2	1						
14:07	281.5	3.2	1	373	0:19	1,178	241	373	0:19
15:56	278.2	3.0	1	2,269	1:49	1,249	239	2,642	2:08
16:10	261.3	3.2	1	112	0:14	480	266	2,754	2:22
16:25	261.3	3.2	1	291	0:15	1,164	202	3,045	2:37
16:37	261.3	3.2	1	408	0:12	2,040	213	3,453	2:49
16:47	261.3	3.2	1	386	0:10	2,316	176	3,839	2:59
17:15	270.3	19.0	7	542	0:28	1,161	191	4,381	3:27
17:27	270.3	19.0	7	374	0:12	1,870	209	4,755	3:39
17:48	270.3	19.0	7	176	0:21	503	260	4,931	4:00
18:12	250.8	98.4	39	188	0:24	470	305	5,119	4:24
18:26	250.8	98.4	39	248	0:14	1,063	212	5,367	4:38
18:42	250.8	98.4	39	230	0:16	863	283	5,597	4:54
19:04	258.1	129.0	50	288	0:22	785	58	5,885	5:16
19:26	258.1	129.0	50	184	0:22	502	51	6,069	5:38
19:48	258.1	129.0	50	365	0:22	995	12	6,434	6:00
20:03	270.2	133.0	49	154	0:15	616	59	6,588	6:15
20:16	270.2	133.0	49	177	0:13	817	102	6,765	6:28
20:42	270.2	133.0	49	131	0:26	302	360	6,896	6:54
21:12	275.2	133.9	49	279	0:30	558	336	7,175	7:24
21:30	275.2	133.9	49	163	0:18	543	92	7,338	7:42

#

At the time this fish was released the John Day River plume was just downstream from the release site. At the time the second location was taken the fish was in the plume. Shortly after the location was recorded the signal was lost. After the signal was found near the Washington shore we had good signal reception. The fish approached the restricted area before dark and at the time the spill pattern was being changed. The track was terminated when the fish continued upstream after dark.


1407
1348
1610
1556
1625
2112
1637
1948
1647
1904
1842
1715
1826
1727
N
0
1
2
kilometers

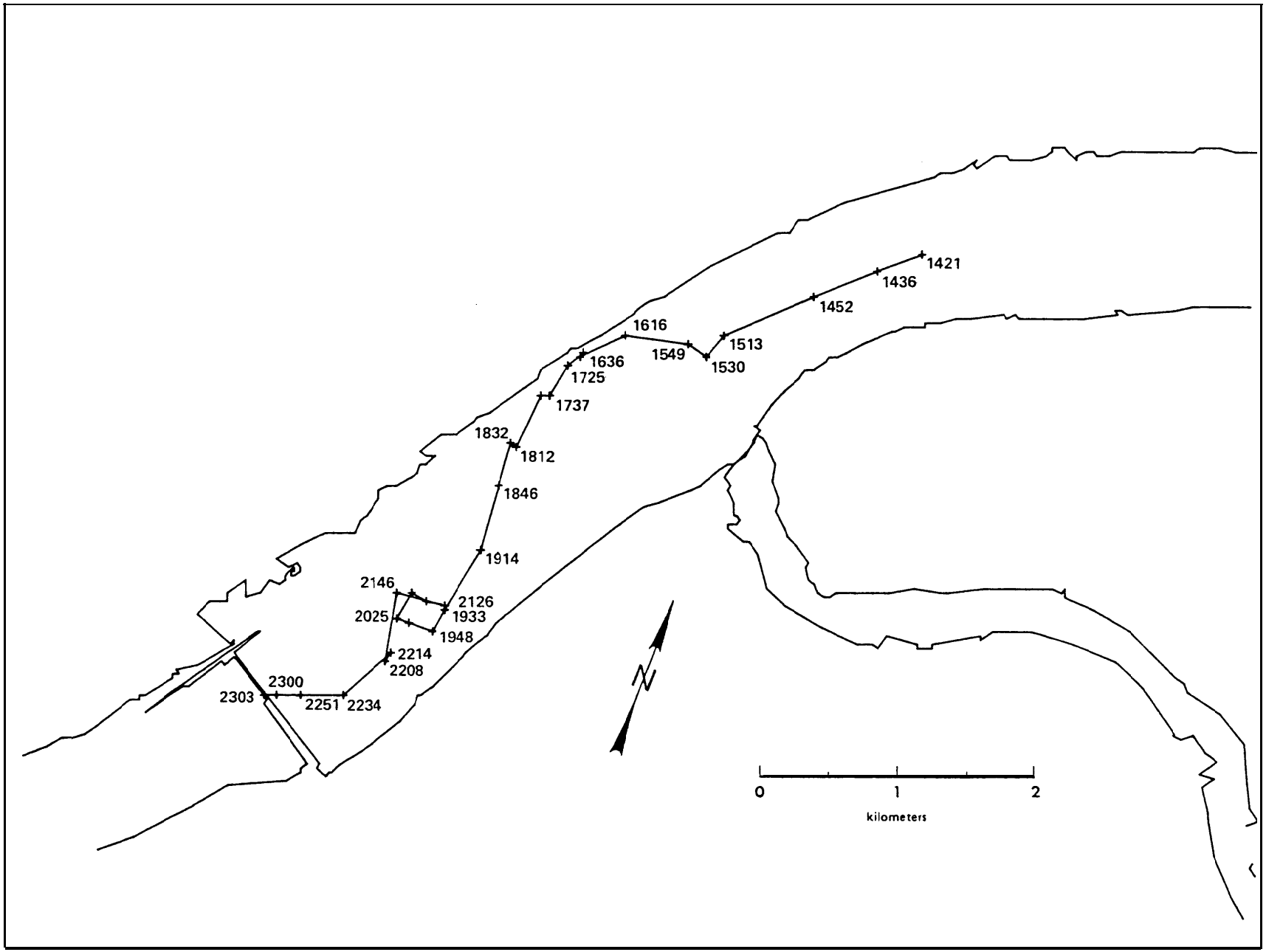
RELEASE DATE: 21 MAY 1983 INDIVIDUAL FISH CODE: 627

SPECIES: SPRING CHINOOK LENGTH: 174 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
14:21	283.3	120.3	42						
14:36	283.3	120.3	42	347	0:15	1,388	229	347	0:15
14:52	283.3	120.3	42	490	0:16	1,838	228	837	0:31
15:13	281.5	120.3	43	706	0:21	2,017	227	1,543	0:52
15:30	281.5	120.3	43	202	0:17	713	200	1,745	1:09
15:49	281.5	120.3	43	159	0:19	502	286	1,904	1:28
16:16	287.7	120.3	42	458	0:27	1,018	258	2,362	1:55
16:36	287.7	120.3	42	359	0:20	1,077	225	2,721	2:15
17:08	253.5	120.3	47	38	0:32	71	15	2,759	2:47
17:25	253.5	120.3	47	142	0:17	501	210	2,901	3:04
17:37	253.5	120.3	47	252	0:12	1,260	191	3,153	3:16
17:53	253.5	120.3	47	65	0:16	244	250	3,218	3:32
18:12	240.1	118.5	49	409	0:19	1,292	185	3,627	3:51
18:32	240.1	118.5	49	53	0:20	159	286	3,680	4:11
18:46	240.1	118.5	49	321	0:14	1,376	176	4,001	4:25
19:14	228.4	118.5	52	481	0:28	1,031	176	4,482	4:53
19:33	228.4	118.5	52	504	0:19	1,592	191	4,986	5:12
19:48	228.4	118.5	52	177	0:15	708	189	5,163	5:27
20:00	228.4	118.5	52	184	0:12	920	270	5,347	5:39
20:25	230.0	120.3	52	92	0:25	221	270	5,439	6:04
20:52	230.0	120.3	52	214	0:27	476	10	5,653	6:31
21:09	256.1	122.0	48	124	0:17	438	100	5,777	6:48
21:26	256.1	122.0	48	133	0:17	469	84	5,910	7:05
21:46	256.1	122.0	48	358	0:20	1,074	265	6,268	7:25
22:08	284.8	143.5	50	501	0:22	1,366	170	6,769	7:47
22:14	284.8	143.5	50	75	0:06	750	15	6,844	7:53
22:34	284.8	143.5	50	464	0:20	1,392	208	7,308	8:13
22:51	284.8	143.5	50	303	0:17	1,069	250	7,611	8:30
23:00	284.8	143.5	50	173	0:09	1,153	250	7,784	8:39
23:03	242.1	127.4	53	86	0:03	1,720	250	7,870	8:42

#

This fish showed the typical behavior of the radio tagged fish to the John Day River plume and to the dam. The plume caused the fish to move to the Washington shore and the fish held up just upstream of the restricted zone until after dark. The last monitor record was at 2256.


1421
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2146
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1933
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2208
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2303
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kilometers

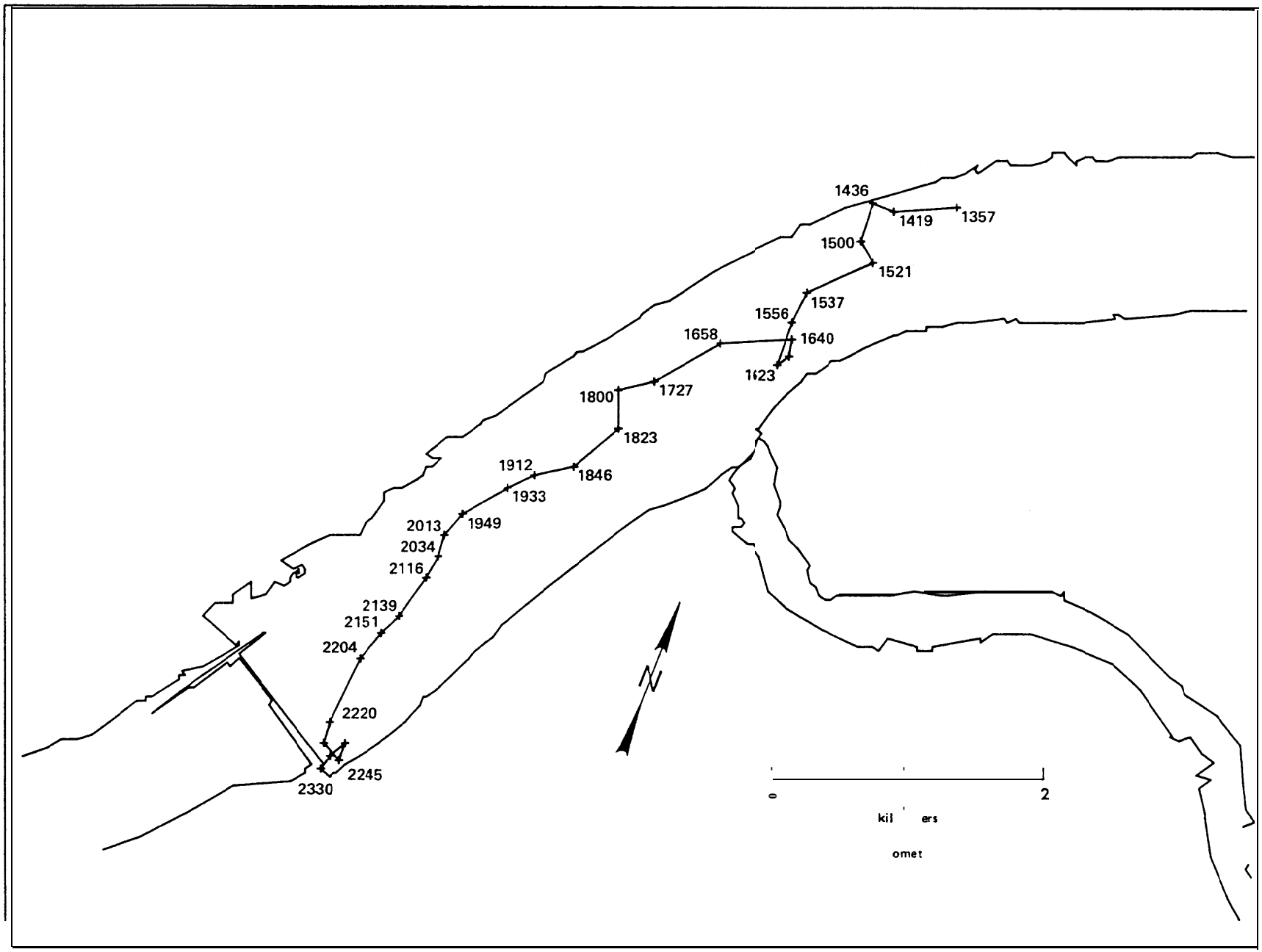
RELEASE DATE: 22 MAY 1983 INDIVIDUAL FISH CODE: 267

SPECIES: COHO LENGTH: 152 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:57	320.7	121.5	38						
14:19	313.0	150.4	48	455	0:22	1,241	246	455	0:22
14:36	313.0	150.4	48	163	0:17	575	272	618	0:39
15:00	313.0	150.4	48	291	0:24	728	177	909	1:03
15:21	315.6	150.4	48	177	0:21	506	131	1,086	1:24
15:37	315.6	150.4	48	522	0:16	1,958	226	1,608	1:40
15:56	315.6	150.4	48	242	0:19	764	187	1,850	1:59
16:23	309.4	150.4	49	327	0:27	727	180	2,177	2:26
16:40	309.4	150.4	49	106	0:17	374	35	2,283	2:43
16:58	309.4	150.4	49	125	0:18	417	350	2,408	3:01
17:27	310.6	150.4	48	541	0:29	1,119	247	2,949	3:30
18:00	310.6	150.4	48	551	0:33	1,002	220	3,500	4:03
18:23	286.9	150.4	52	267	0:23	697	237	3,767	4:26
18:46	286.9	150.4	52	278	0:23	725	160	4,045	4:49
19:12	297.6	150.4	51	427	0:26	985	210	4,472	5:15
19:33	297.6	150.4	51	288	0:21	823	238	4,760	5:36
19:49	297.6	150.4	51	216	0:16	810	225	4,976	5:52
20:13	299.8	150.4	50	373	0:24	933	220	5,349	6:16
20:34	299.8	150.4	50	202	0:21	577	200	5,551	6:37
20:54	299.8	150.4	50	160	0:20	480	176	5,711	6:57
21:16	302.3	148.1	49	177	0:22	483	189	5,888	7:19
21:39	302.3	148.1	49	339	0:23	884	195	6,227	7:42
21:51	302.3	148.1	49	179	0:12	895	207	6,406	7:54
22:04	268.0	140.9	53	239	0:13	1,103	199	6,645	8:07
22:20	268.0	140.9	53	511	0:16	1,916	185	7,156	8:23
22:32	268.0	140.9	53	160	0:12	800	176	7,316	8:35
22:45	268.0	1413.9	53	164	0:13	757	119	7,480	8:48
22:54	268.0	140.9	53	131	0:09	873	360	7,611	8:57
23:13	242.3	139.9	58	142	0:19	448	210	7,753	9:16
23:30	242.3	139.9	58	113	0:17	399	195	7,866	9:33

#

This is one of two coho salmon that were released when chinook salmon were not available. This fish avoided the John Day River plume and slowed when it got to the restricted zone. It crossed the river (Washington to Oregon) during a period of high spill, and it passed downstream via the Oregon shore Fishladder.


1436
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kil ers
omet

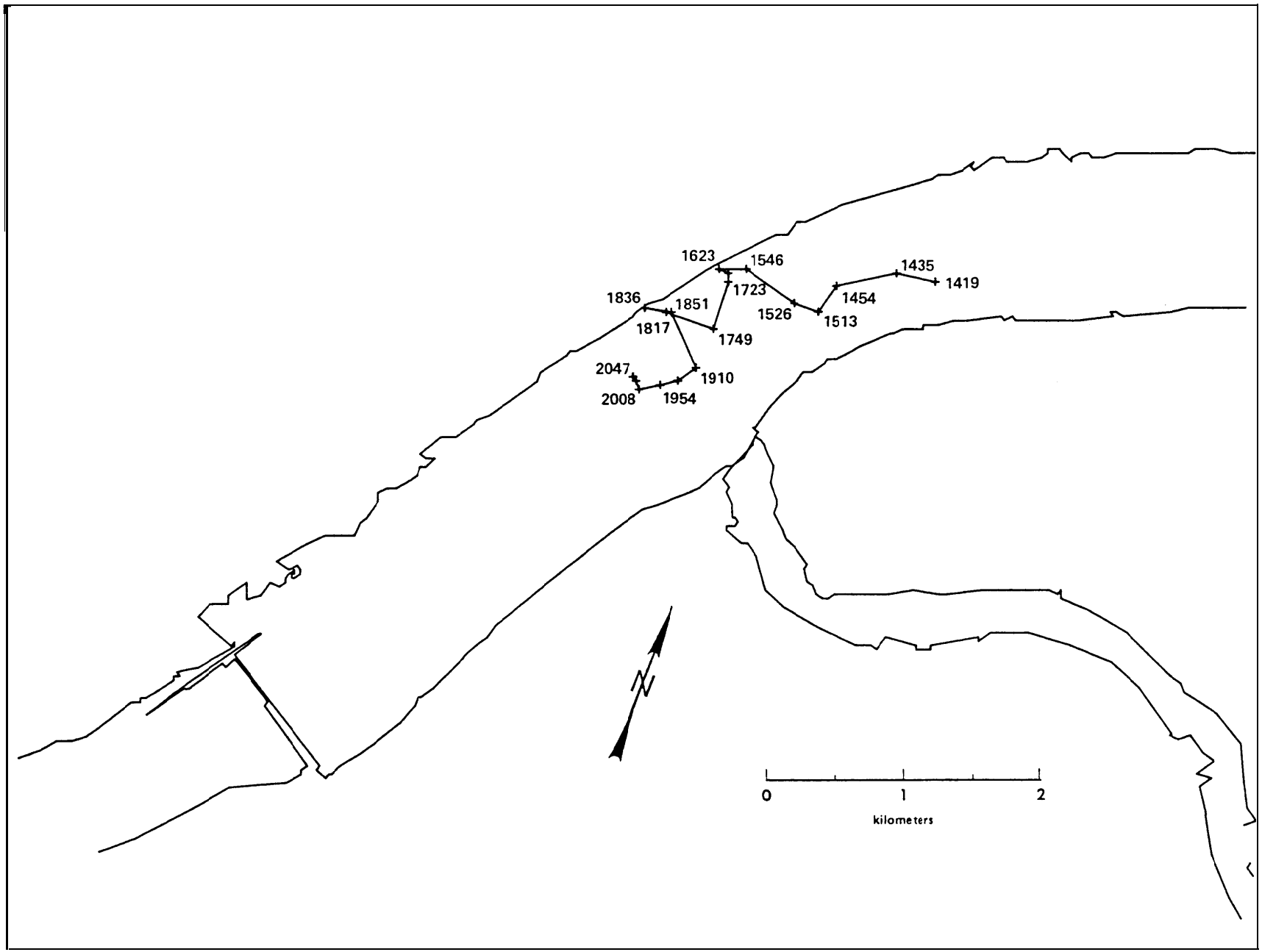
RELEASE DATE: 23 MAY 1983 INDIVIDUAL FISH CODE: 928

SPECIES: COHO LENGTH: 179 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
14:19	276.9	35.2	13						
14:35	276.9	35.2	13	288	0:16	1,080	263	288	0:16
14:54	276.9	35.2	13	442	0:19	1,396	238	730	0:35
15:13	265.5	35.2	13	226	0:19	714	195	956	0:54
15:26	265.5	35.2	13	184	0:13	849	270	1,140	1:07
15:46	265.5	35.2	13	425	0:20	1,275	286	1,565	1:27
16:23	254.3	64.0	25	195	0:37	316	250	1,760	2:04
16:53	254.3	64.0	25	72	0:30	144	96	1,832	2:34
17:23	261.3	120.3	46	62	0:30	124	160	1,894	3:04
17: 49	261.3	120.3	46	356	0:26	822	178	2,250	3:30
18:17	272.8	130.0	48	367	0:28	786	270	2,617	3:58
18:36	272.8	130.0	48	154	0:19	486	262	2,771	4:17
18:51	272.8	130.0	48	197	0:15	788	79	2,968	4:32
19:10	277.7	129.6	47	437	0:19	1,380	137	3,405	4:51
19:28	277.7	129.6	47	159	0:18	530	215	3,564	5:09
19:54	277.7	129.6	47	133	0:26	307	237	3,697	5:35
20:08	315.8	154.0	49	154	0:14	660	239	3,851	5:49
20:22	315.8	154.0	49	65	0:14	279	321	3,916	6:03
20:47	315.8	154.0	49	38	0:25	91	305	3,954	6:28

#

This coho salmon showed a strong avoidance of the John Day River plume. It was holding upstream of the plume at sunset when the track was abandon due to no downstream movement. Passage at the dam was recorded by the spillway monitors at 0420 on 24 May.


1623
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1419
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1454
1526
1513
1817
1749
2047
1910
2008
1954
0
1
2
kilometers

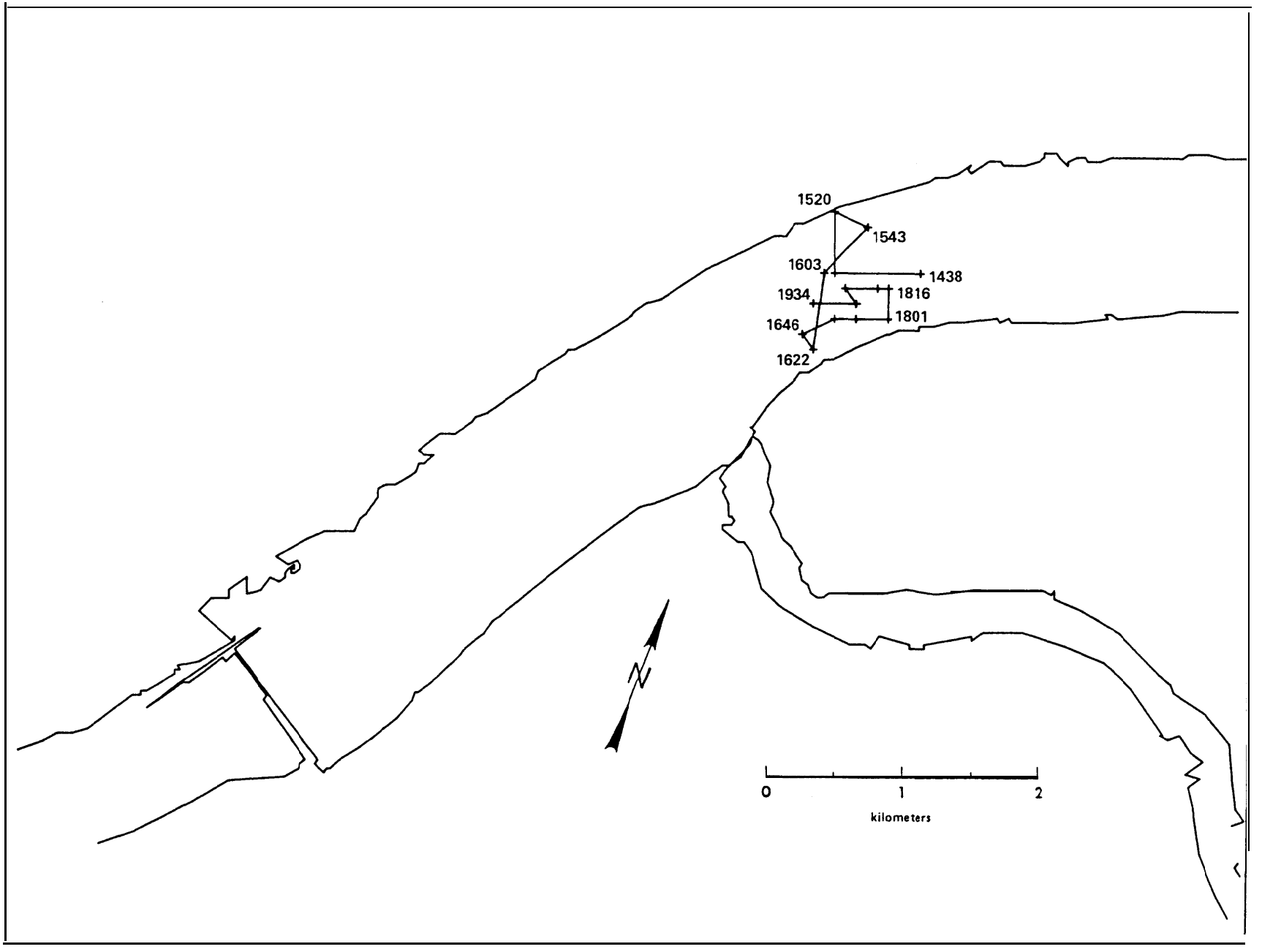
RELEASE DATE: 24 MAY 1983 INDIVIDUAL FISH CODE: 766

SPECIES: STEELHEAD LENGTH: 165 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
14:38	334.8	119.5	36						
15:00	334.8	119.5	36	585	0:22	1,595	247	585	0:22
15:20	331.6	119.5	36	433	0:20	1,299	337	1,018	0:42
15:43	331.6	119.5	36	246	0:23	642	85	1,264	1:05
16:03	320.2	119.5	37	503	0:20	1,509	197	1,767	1:25
16:22	320.2	119.5	37	468	0:19	1,478	168	2,235	1:44
16:46	320.2	119.5	37	72	0:24	180	276	2,307	2:08
17:10	266.4	119.5	45	255	0:24	638	49	2,562	2:32
17:30	266.4	119.5	45	144	0:20	432	45	2,706	2:52
18:01	265.1	119.5	45	259	0:31	501	70	2,965	3:23
18:16	265.1	119.5	45	185	0:15	740	340	3,150	3:38
18:33	265.1	119.5	45	124	0:17	438	280	3,274	3:55
18:54	265.1	119.5	45	255	0:21	729	229	3,529	4:16
19: 10	300.6	149.6	50	92	0:16	345	90	3,621	4:32
19:34	300.6	149.6	50	330	0:24	825	239	3,951	4:56

#

This was the first steelhead release in 1983. Besides indicating why we prefer to track chinook salmon, this fish was in and out of the John Day River plume while closest to the Oregon shore. Passage of the dam was recorded by the spillway monitors at 1734 on 25 May.


1520
1543
1603
1438
1934
1816
1801
1646
1622
0
1
2
kilometers

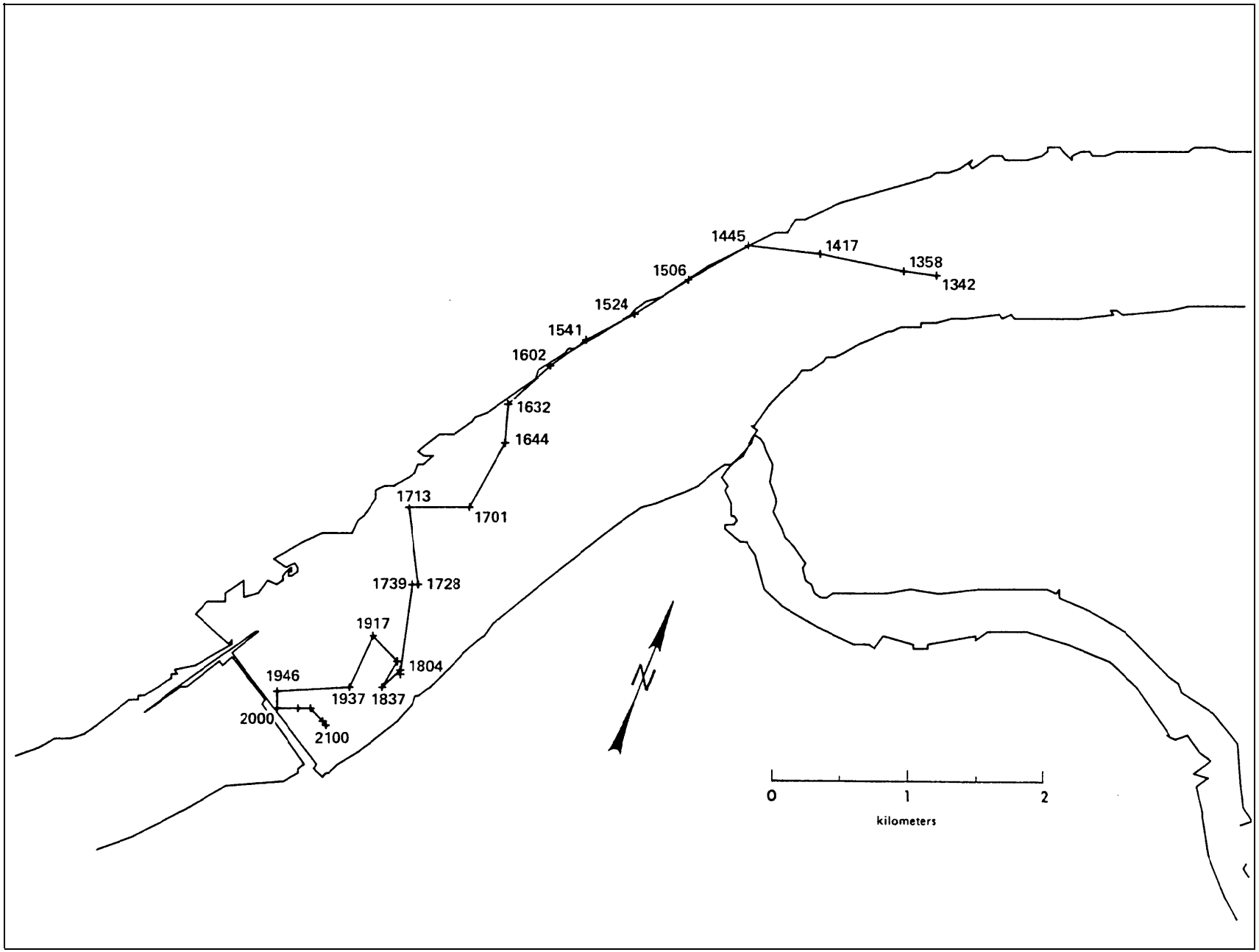
RELEASE DATE: 25 MAY 1983 INDIVIDUAL FISH CODE: 144

SPECIES: SPRING CHINOOK LENGTH: 159 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:42	349.4	121.9	35						
13:58	349.4	121.9	35	240	0:16	900	258	240	0:16
14:17	335.3	121.9	36	618	0:19	1,952	262	858	0:35
14:45	335.3	121.9	36	523	0:28	1,121	257	1,381	1:03
15:06	332.6	121.9	37	498	0:21	1,423	220	1,879	1:24
15:24	332.6	121.9	37	461	0:18	1,537	218	2,340	1:42
15:41	332.6	121.9	37	392	0:17	1,384	222	2,732	1:59
16:02	330.3	121.5	37	319	0:21	911	215	3,051	2:20
16:32	330.3	121.5	37	411	0:30	822	208	3,462	2:50
16:44	330.3	121.5	37	279	0:12	1,395	165	3,741	3:02
17:01	366.5	150.1	41	531	0:17	1,874	189	4,272	3:19
17:13	366.5	150.1	41	432	0:12	2,160	250	4,704	3:31
17:28	366.5	150.1	41	559	0:15	2,236	154	5,263	3:46
17:39	366.5	150.1	41	43	0:11	235	250	5,306	3:57
17:55	366.5	150.1	41	654	0:16	2,453	168	5,960	4:13
18:04	262.1	150.4	57	31	0:09	207	340	5,991	4:22
18:37	262.1	150.4	57	179	0:33	325	207	6,170	4:55
18:54	262.1	150.4	57	214	0:17	755	10	6,384	5:12
19:17	335.8	172.9	51	253	0:23	660	297	6,637	5:35
19:37	335.8	172.9	51	409	0:20	1,227	185	7,046	5:55
19:46	335.8	172.9	51	520	0:09	3,467	247	7,566	6:04
20:00	335.8	172.9	51	123	0:14	527	160	7,689	6:18
20:24	364.5	180.5	50	151	0:24	378	70	7,840	6:42
20: 29	364.5	180.5	50	86	0:05	1,032	70	7,926	6:47
20:45	364.5	180.5	50	127	0:16	476	117	8,053	7:03
21:00	364.5	180.5	50	38	0:15	152	125	8,091	7:18

#

This fish moved downstream very rapidly. It moved to the Washington shore to avoid the plume and held up at the upstream edge of the restricted zone. This was the third chinook salmon that was lost in the restricted zone after dark. The track was terminated after an unsuccessful search. The spillway monitor last recorded the tag signal at 2329 on 25 May.


1445
1417
1358
1342
1506
1524
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1602
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1739
1728
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1946
1937
1837
2000
2100
0
1
2
kilometers

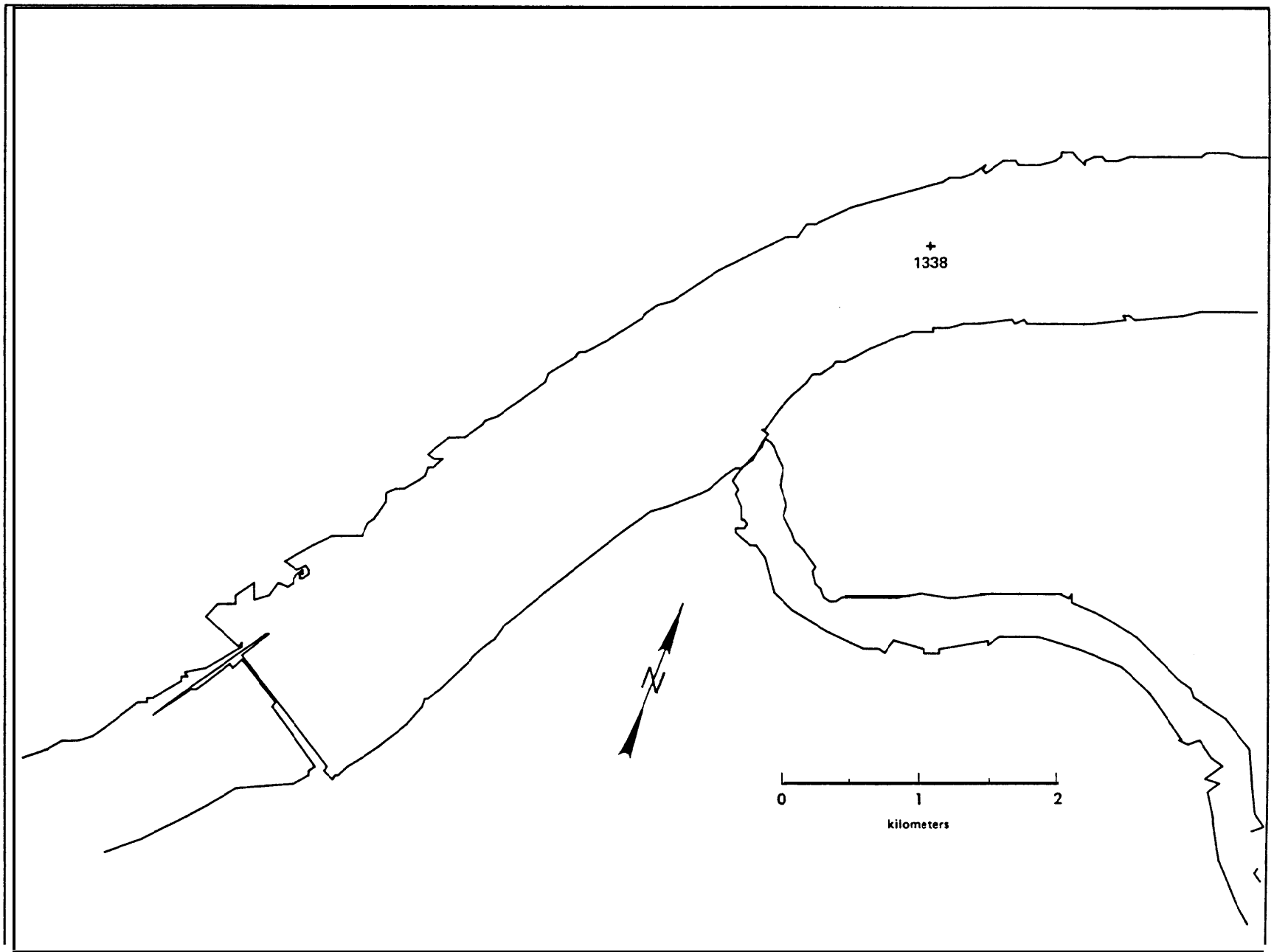
RELEASE DATE: 3 JUNE 1983 INDIVIDUAL FISH CODE: 133

SPECIES: STEELHEAD LENGTH: 165 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:38	384.9	190.0	49						
13:40	384.9	190.0	49	0	Ø:Ø2	0	-*-	0	Ø:Ø2

#

This fish appeared to dive immediately upon release and was never heard again during two hours of searching. The search was called off when the wind increased the wave height and the crew's safety became an overriding concern.


1338
N
0
1
2
kilometers

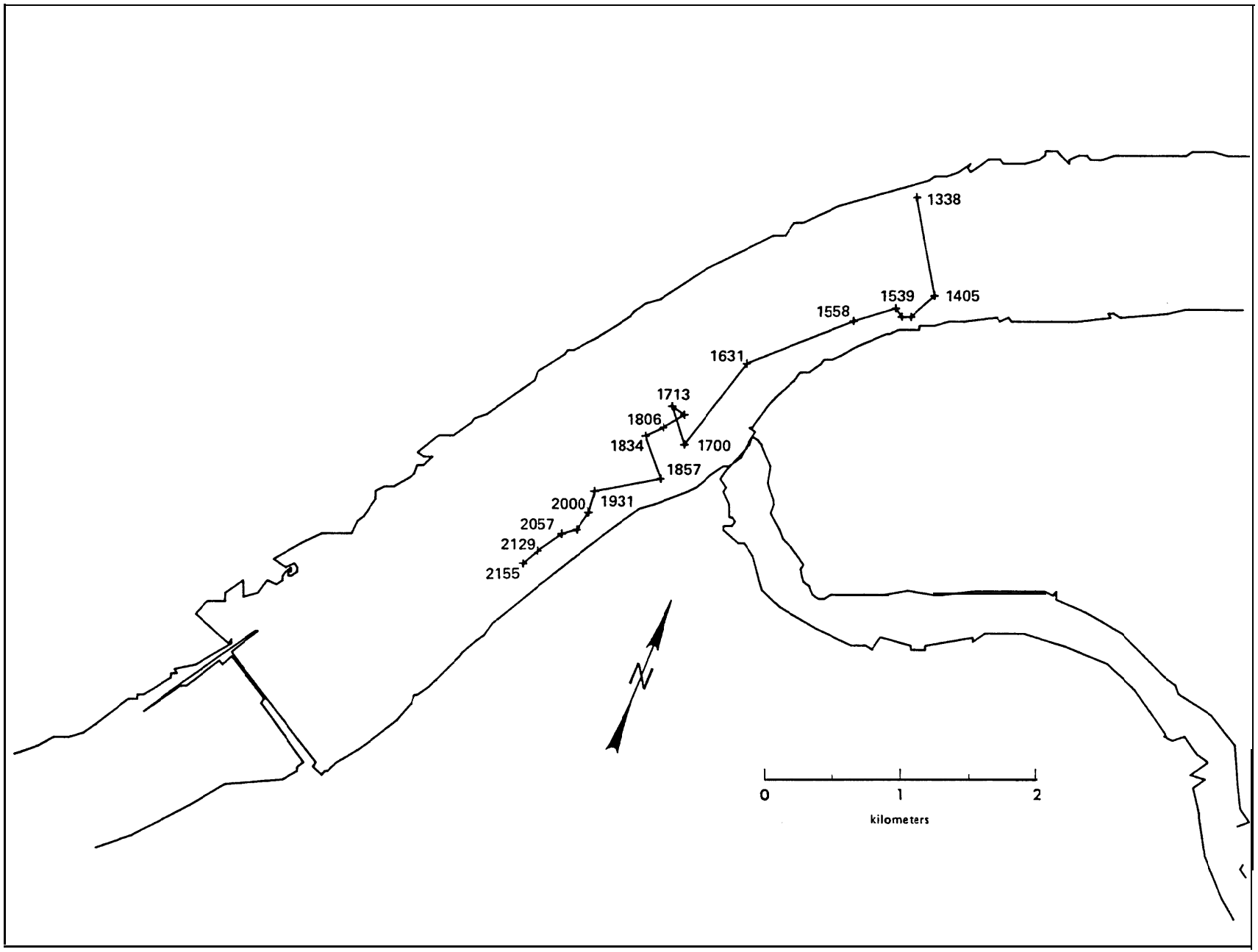
RELEASE DATE: 5 JUNE 1983 INDIVIDUAL FISH CODE: 667

SPECIES: STEELHEAD LENGTH: 189 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:38	354.5	180.5	51						
14:05	358.0	180.5	50	722	0:27	1,604	150	722	0:27
14:36	358.0	180.5	50	232	0:31	449	208	954	0:58
15:08	358.6	180.5	50	65	0:32	122	250	1,019	1:30
15:39	358.6	180.5	50	75	0:31	145	305	1,094	2:01
15:58	358.6	180.5	50	317	0:19	1,001	233	1,411	2:20
16:31	359.2	181.3	50	837	0:33	1,522	229	2,248	2:53
17:00	359.2	181.3	50	742	0:29	1,535	198	2,990	3:22
17:13	359.2	183.6	51	291	0:13	1,343	323	3,281	3:35
17:36	359.2	183.6	51	106	0:23	277	106	3,387	3:58
18:06	360.5	183.6	51	177	0:30	354	219	3,564	4:28
18:34	360.5	183.6	51	144	0:28	309	225	3,708	4:56
18:57	360.5	183.6	51	327	0:23	853	141	4,035	5:19
19:31	361.8	183.6	51	485	0:34	856	239	4,520	5:53
20:00	361.8	183.6	51	160	0:29	331	176	4,680	6:22
20:26	360.4	183.4	51	151	0:26	348	195	4,831	6:48
20:57	360.4	183.4	51	112	0:31	217	234	4,943	7:19
21:29	359.0	183.6	51	213	0:32	399	215	5,156	7:51
21:55	359.0	183.6	51	142	0:26	328	210	5,298	8:17

#

This steelhead was not a problem to track, but moved downstream very slowly. It showed no avoidance behavior when it entered the John Day River plume and it eventually passed through the powerhouse. The track was terminated because of the slow movement. The powerhouse monitors recorded the downstream passage at 0515 on 7 June.


1338
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2129
2155
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1
2
kilometers

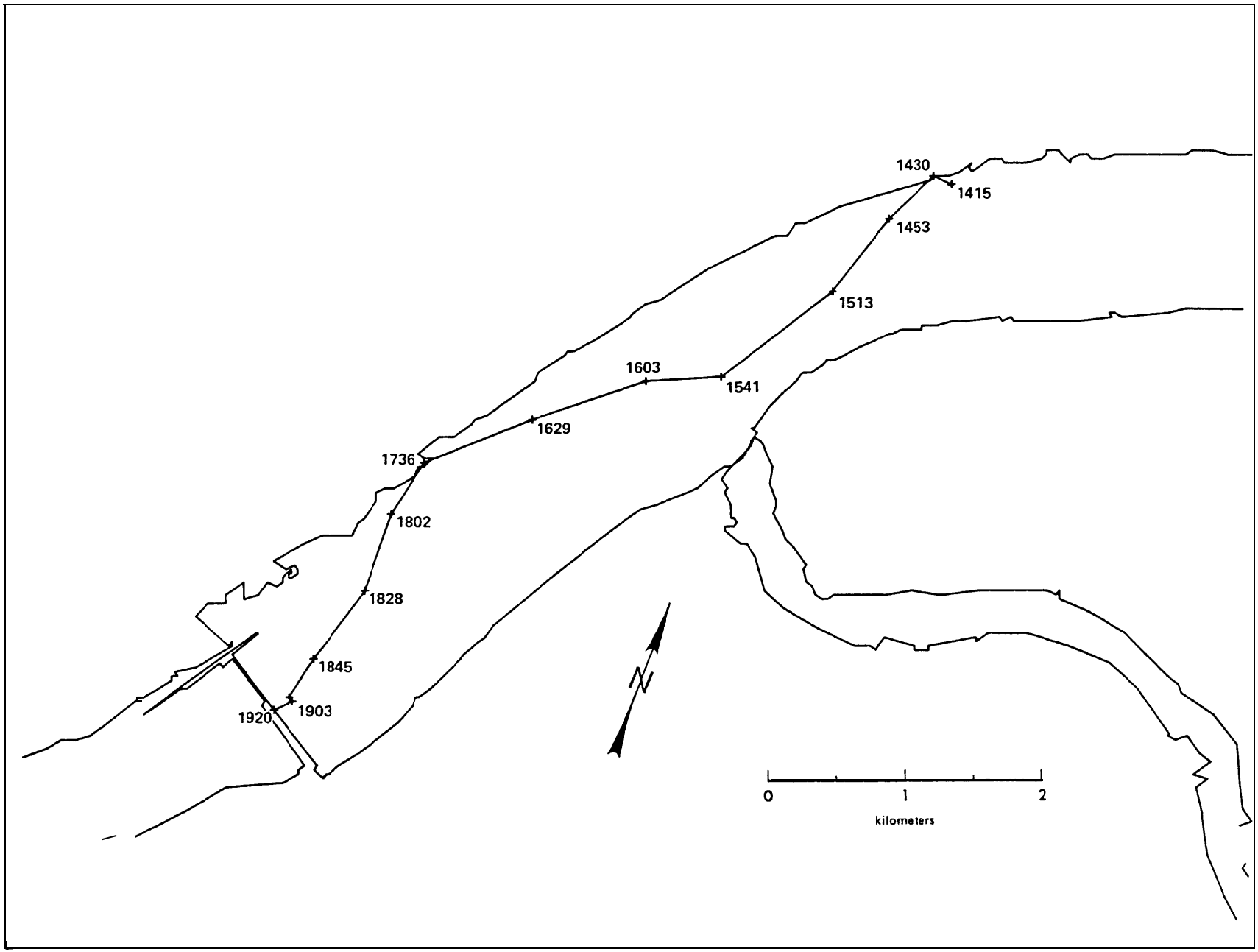
RELEASE DATE: 6 JUNE 1983 INDIVIDUAL FISH CODE: 246

SPECIES: SPRING CHINOOK LENGTH: 180 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAC)	CUMULATIVE DISTANCE	CUMULATIVE TIME
14:15	373.8	184.2	49						
14:30	373.8	184.2	49	144	0:15	576	276	144	0:15
14:53	373.8	184.2	49	448	0:23	1,169	207	592	0:38
15:13	372.4	190.0	51	666	0:20	1,998	198	1,258	0:58
15:41	372.4	190.0	51	1,011	0:28	2,166	213	2,269	1:26
16:03	371.9	190.8	51	541	0:22	1,475	247	2,810	1:48
16:29	371.9	190.8	51	867	0:26	2,001	232	3,677	2:14
17:36	375.3	178.9	48	837	1:07	750	229	4,514	3:21
18:02	378.9	177.3	47	440	0:26	1,015	193	4,954	3:47
18:28	378.9	177.3	47	589	0:26	1,359	180	5,543	4:13
18:45	378.9	177.3	47	616	0:17	2,174	197	6,159	4:30
18:59	378.9	177.3	47	327	0:14	1,401	192	6,486	4:44
19:03	372.1	177.3	48	38	0:04	570	125	6,524	4:48
19:20	372.1	177.3	48	144	0:17	508	225	6,668	5:05

#

This fish reacted to the John Day River plume, but did not hold up above the restricted zone during its approach. Spill during the period that the fish crossed from the Washington shore to the powerhouse may not have been effective because of daylight behavior patterns near the dam (an area not concentrated upon during any of the work at John Day Dam).

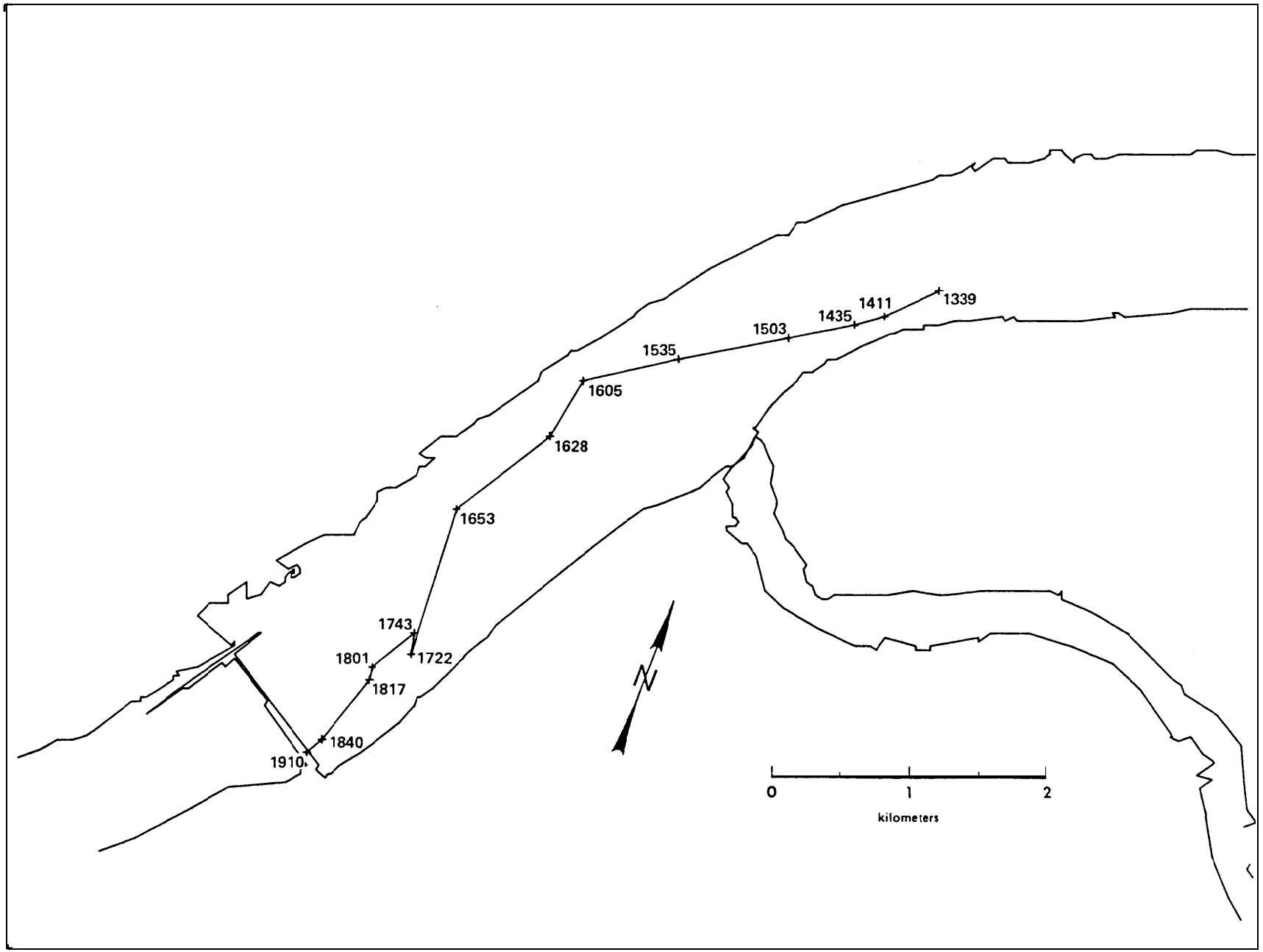

1430
1415
1453
1513
1603
1541
1629
1736
1802
1828
1845
1903
1920
0
1
2
kilometers

RELEASE DATE: 7 JUNE 1983 INDIVIDUAL FISH CODE: 575

SPECIES: STEELHEAD LENGTH: 175 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:39	341.7	119.5	35						
14:11	345.4	160.9	47	431	0:32	808	225	431	0:32
14:35	345.4	160.9	47	225	0:24	563	234	656	0:56
15:03	356.2	170.0	48	485	0:28	1,039	239	1,141	1:24
15:35	356.2	170.0	48	815	0:32	1,528	239	1,956	1:56
16:05	351.9	163.1	46	709	0:30	1,418	238	2,665	2:26
16:28	351.9	163.1	46	466	0:23	1,216	191	3,131	2:49
16:53	351.9	163.1	46	851	0:25	2,042	212	3,982	3:14
17:22	357.4	154.5	43	1,098	0:29	2,272	177	5,080	3:43
17:43	357.4	154.5	43	156	0:21	446	348	5,236	4:04
18:01	351.8	156.7	45	391	0:18	1,303	211	5,627	4:22
18:17	351.8	156.7	45	95	0:16	356	173	5,722	4:38
18:40	351.8	156.7	45	554	0:23	1,445	199	6,276	5:01
19:10	347.3	150.2	43	142	0:30	284	210	6,418	5:31

This is one steelhead that was influenced by the John Day River plume. It also showed an avoidance behavior as it approached the restricted zone, but it continued downstream for a daylight passage. The cross over from the Washington side to the powerhouse side under high spill was observed here and with one chinook salmon, both during daylight periods.


1339
1411
1435
1503
1535
1605
1628
1653
1743
1722
1801
1817
1840
1910
0
1
2
kilometers

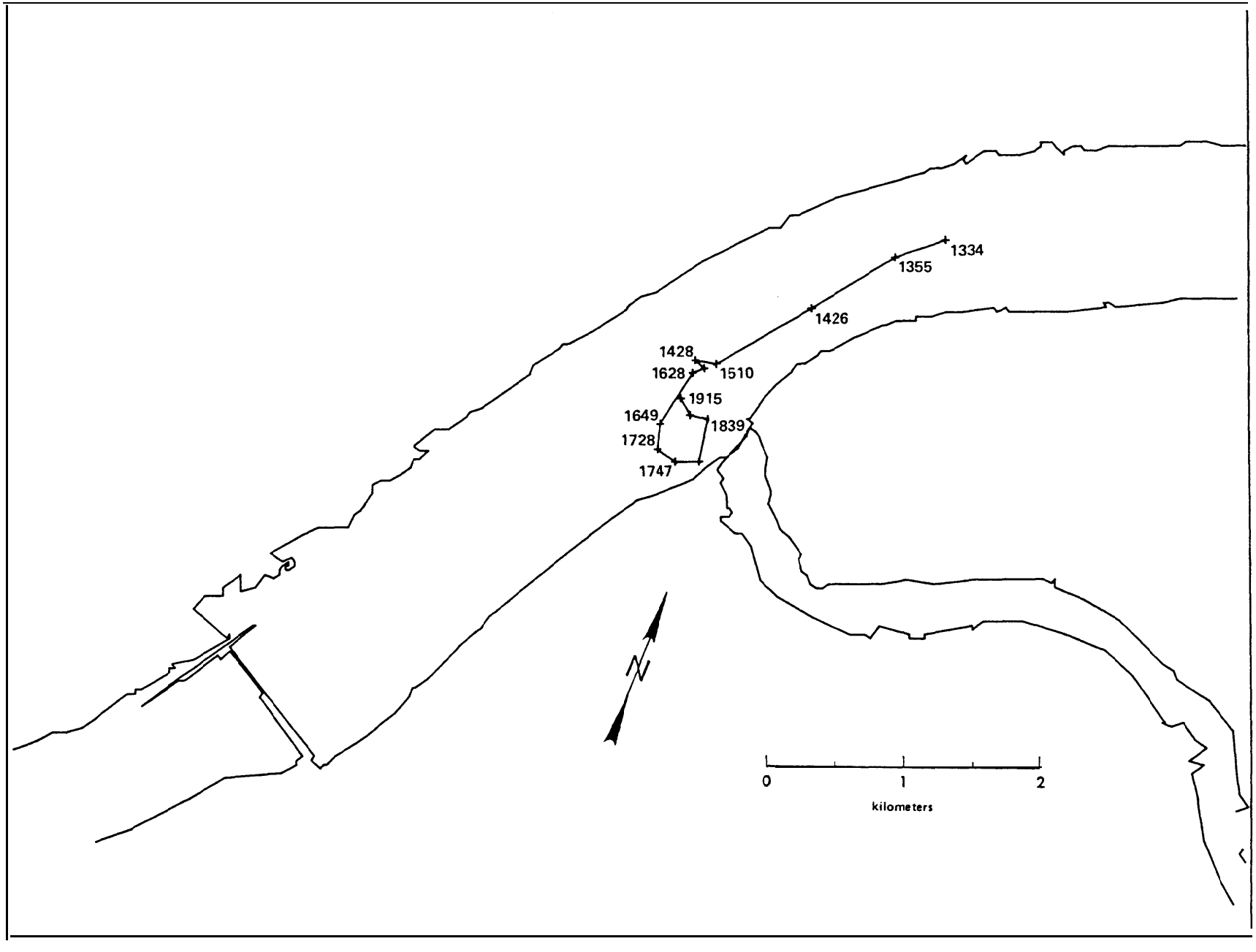
RELEASE DATE: 8 JUNE 1983 INDIVIDUAL FISH CODE: 728

SPECIES: STEELHEAD LENGTH: 172 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:34	344.8	92.8	27						
13:55	344.8	92.8	27	388	Ø:21	1,109	232	388	Ø:21
14:26	353.1	145.0	41	710	Ø:31	1,374	219	1,098	Ø:52
15:1Ø	343.4	161.3	47	800	Ø:44	1,091	220	1,898	1:36
15:28	343.4	161.3	47	154	Ø:18	513	262	2,052	1:54
15:59	343.4	161.3	47	90	Ø:31	174	114	2,142	2:25
16:28	351.6	169.4	48	92	Ø:29	190	231	2,234	2:54
16:49	351.6	169.4	48	440	Ø:21	1,257	193	2,674	3:15
17:28	351.6	169.4	48	186	0: 39	286	167	2,860	3:54
17:47	351.6	169.4	48	159	Ø:19	502	106	3,019	4:13
18:15	350.5	169.4	48	173	Ø:28	371	70	3,192	4:41
18:39	350.5	169.4	48	315	Ø:24	788	352	3,507	5:Ø5
19:ØØ	350.5	169.4	48	133	Ø:21	380	264	3,640	5:26
19:15	353.4	169.6	48	139	Ø:15	556	312	3,779	5:41

#

This fish moved downstream from the release site until it reached the mouth of the John Day River. After holding for a short period it entered the plume and went into a holding pattern. With no downstream movement and worsening wave conditions the track was abandoned.


1334
1355
1426
1428
1628
1510
1915
1649
1839
1728
1747
0
1
2
kilometers

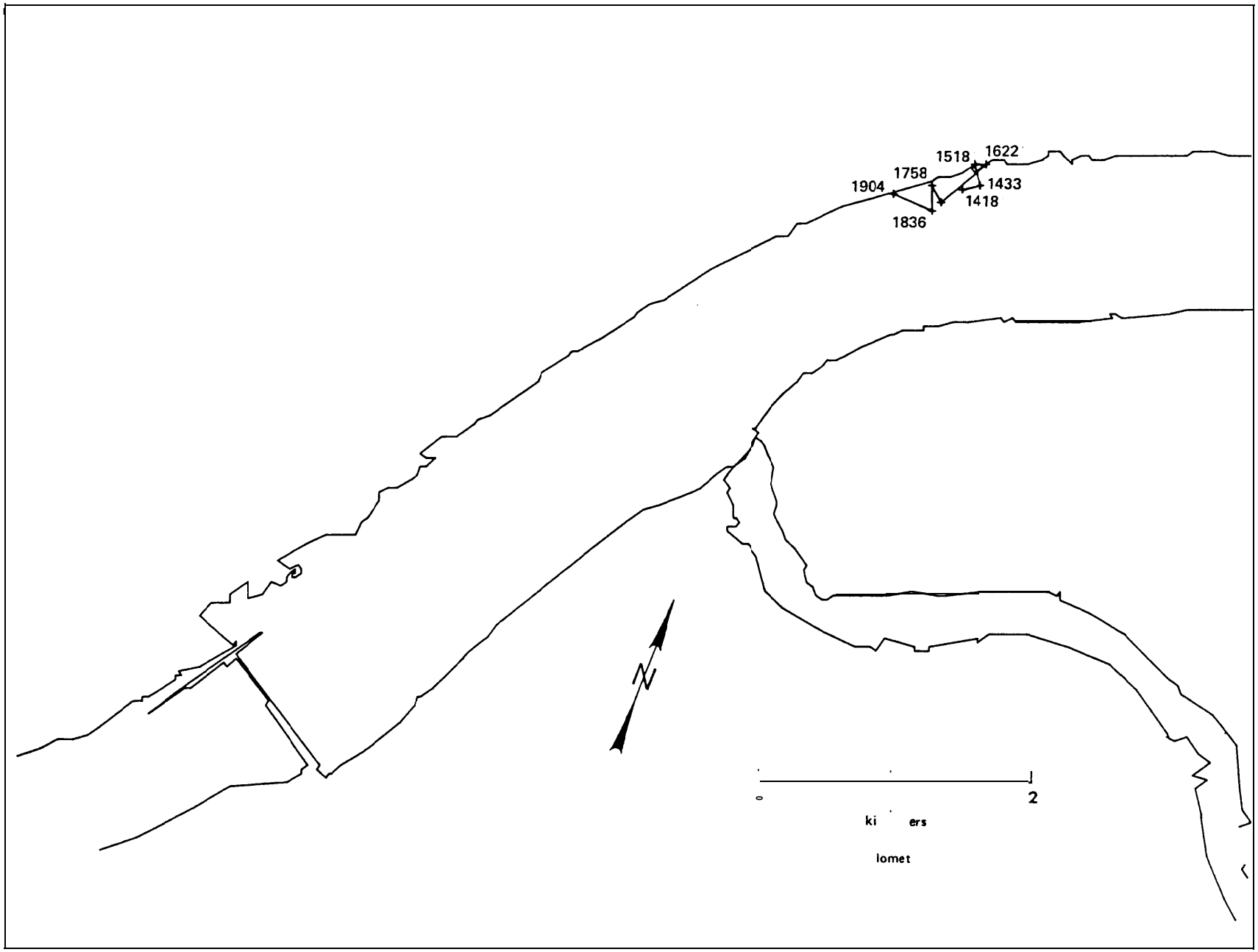
RELEASE DATE: 9 JUNE 1983 INDIVIDUAL FISH CODE: 146

SPECIES: STEELHEAD LENGTH: 177 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
14:18	343.0	147.7	43						
14:33	343.0	147.7	43	133	0:15	532	57	133	0:15
15:18	345.8	175.0	51	160	0:45	213	325	293	1:00
16:22	353.3	182.1	52	0	1:04	0	-*-	293	2:04
16:46	353.3	182.1	52	86	0:24	215	70	379	2:28
17:27	345.3	173.8	50	427	0:41	625	210	806	3:09
17:58	345.3	173.8	50	139	0:31	269	312	945	3:40
18:36	301.8	2.2	1	185	0:38	292	160	1,130	4:18
19:04	347.6	121.7	35	307	0:28	658	274	1,437	4:46

#

This steelhead did not make significant movement toward the dam during any period of the track. The track was terminated when light conditions made it impossible to obtain position locations.


1518
1622
1758
1904
1433
1418
1836
N
0
2
ki ers
lomet

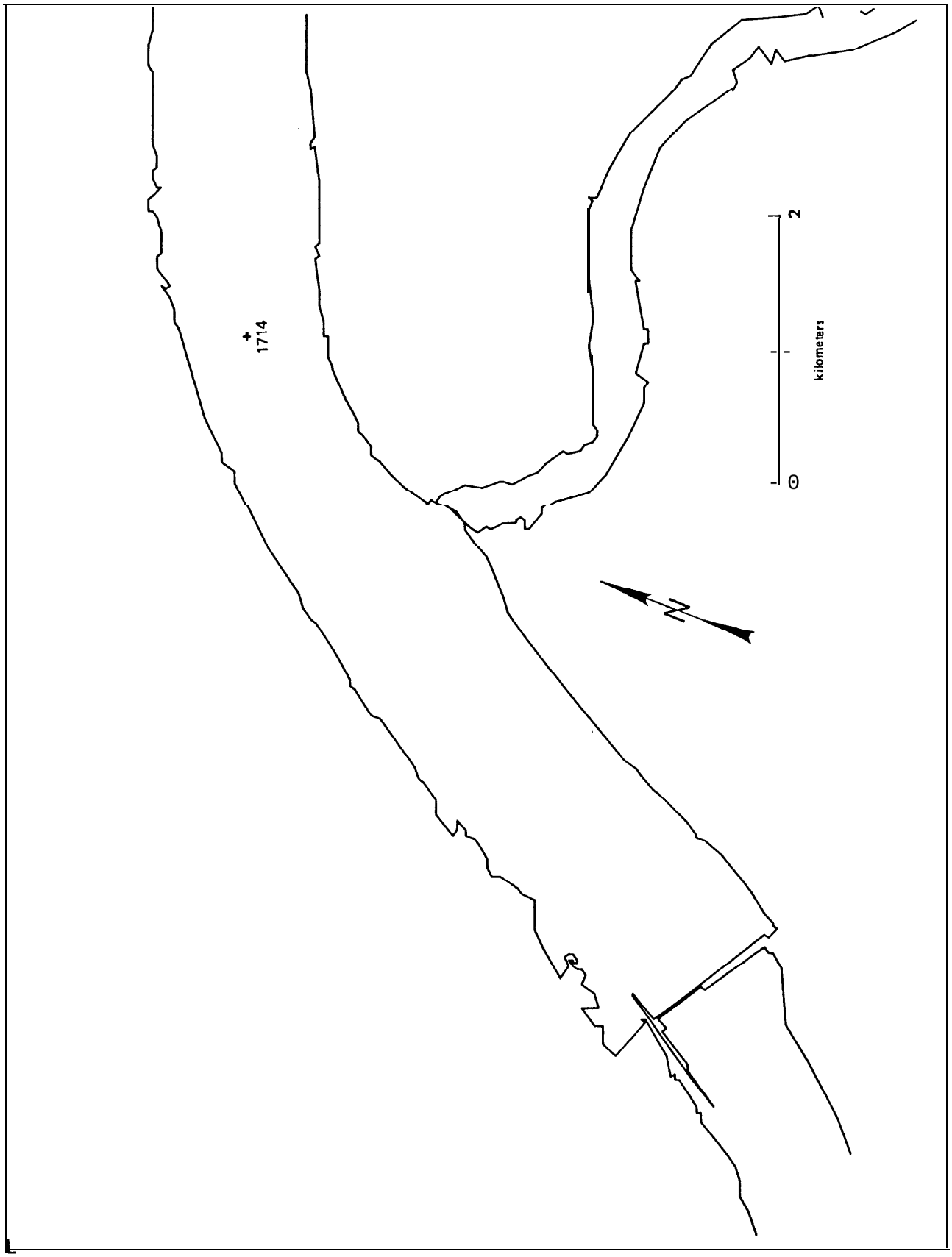
RELEASE DATE: 15 JUNE 1983 INDIVIDUAL FISH CODE: 363

SPECIES: SPRING CHINOOK LENGTH: 150 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MA3&	CUMULATIVE DISTANCE	CUMULATIVE TIME
17:14	252.1	0.0	0						
17:15	252.1	0.0	0	0	0:01	0	,*,	0	0:01

#

This fish was released in a high wind situation to test the effect of wave action on arrival time at the dam. Radio tracking was not attempted, No record of passage was recorded by the monitors on the face of the dam.


1714
2
0
kilometers
N

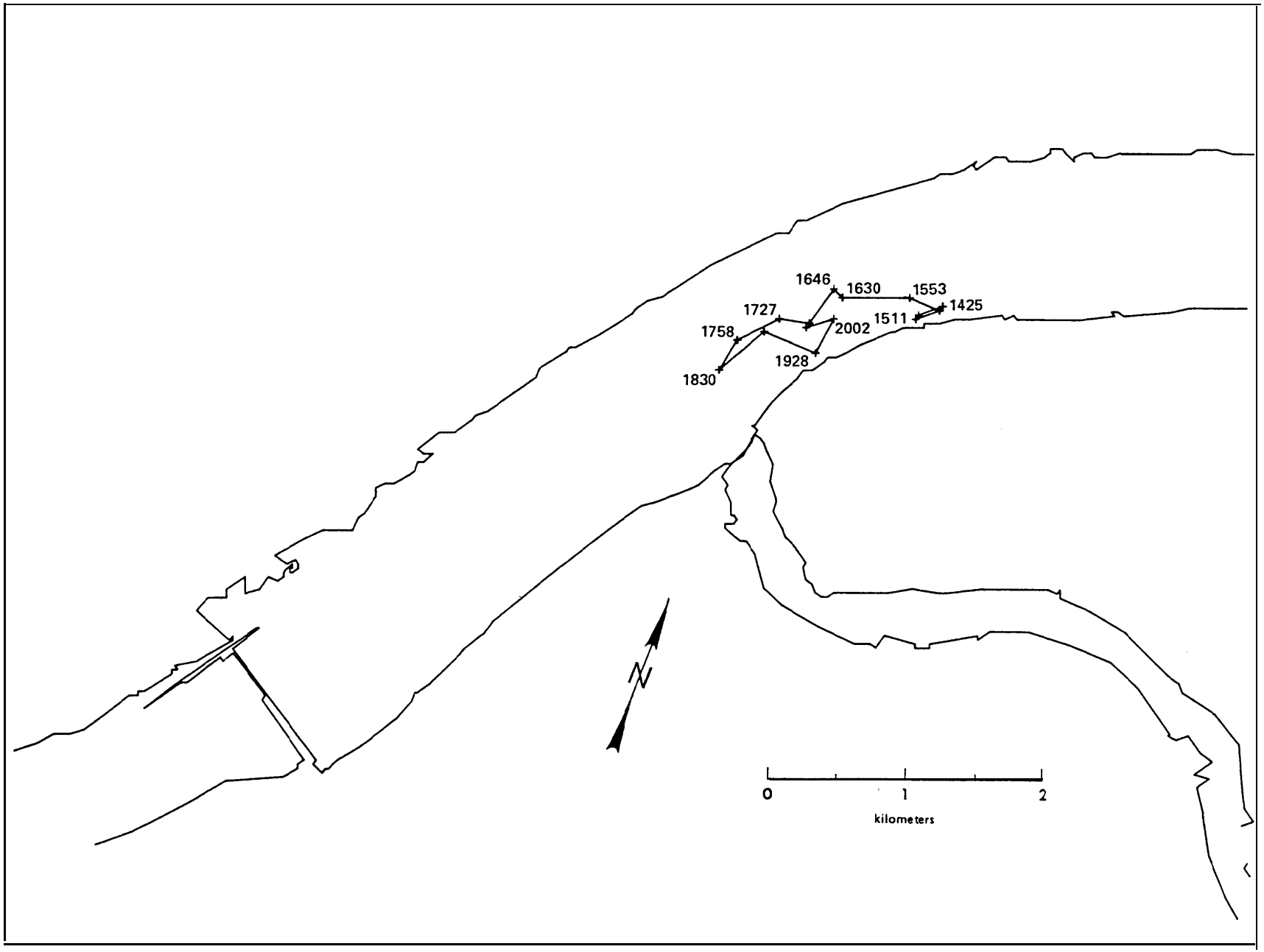
RELEASE DATE: 16 JUNE 1983 INDIVIDUAL FISH CODE: 527

SPECIES: STEELHEAD LENGTH: 173 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
14:25	270.3	0.0	Ø						
14:43	270.3	0.0	0	184	Ø:18	613	231	184	Ø:18
15:11	275.6	0.0	0	38	Ø:28	81	195	222	Ø:46
15:26	275.6	0.0	0	184	Ø:15	736	51	406	1:Ø1
15:53	275.6	0.0	0	235	Ø:27	522	273	641	1:28
16:3Ø	271.9	0.0	0	476	Ø:37	772	250	1,117	2:Ø5
16:46	271.9	0.0	0	90	Ø:16	338	294	1,207	2:21
17:Ø7	268.6	0.0	0	301	Ø:21	860	195	1,508	2:42
17:27	268.6	0.0	0	218	Ø:2Ø	654	258	1,726	3:Ø2
17:58	268.6	0.0	0	340	Ø:31	658	223	2,066	3:33
18:3Ø	264.2	0.0	0	252	Ø:32	473	191	2,318	4:Ø5
19:Ø3	241.9	3.3	1	427	Ø:33	776	30	2,745	4:38
19:28	241.9	3.3		399	Ø:25	958	93	3,144	5:Ø3
2Ø:Ø2	296.2	142.2	48	279	Ø:34	492	8	3,423	5:37
2Ø:31	296.2	142.2	48	204	0: 29	422	233	3,627	6:Ø6

#

This steelhead reacted to the John Day River plume but did not move to the Washington shore or downstream. The track was abandoned becuase light conditions did not permit adequate position readings. The powerhouse monitors recorded downstream passage at 0503 on 18 June.


1646
1630
1553
1425
1727
1511
1758
2002
1928
1830
N
0
1
2
kilometers

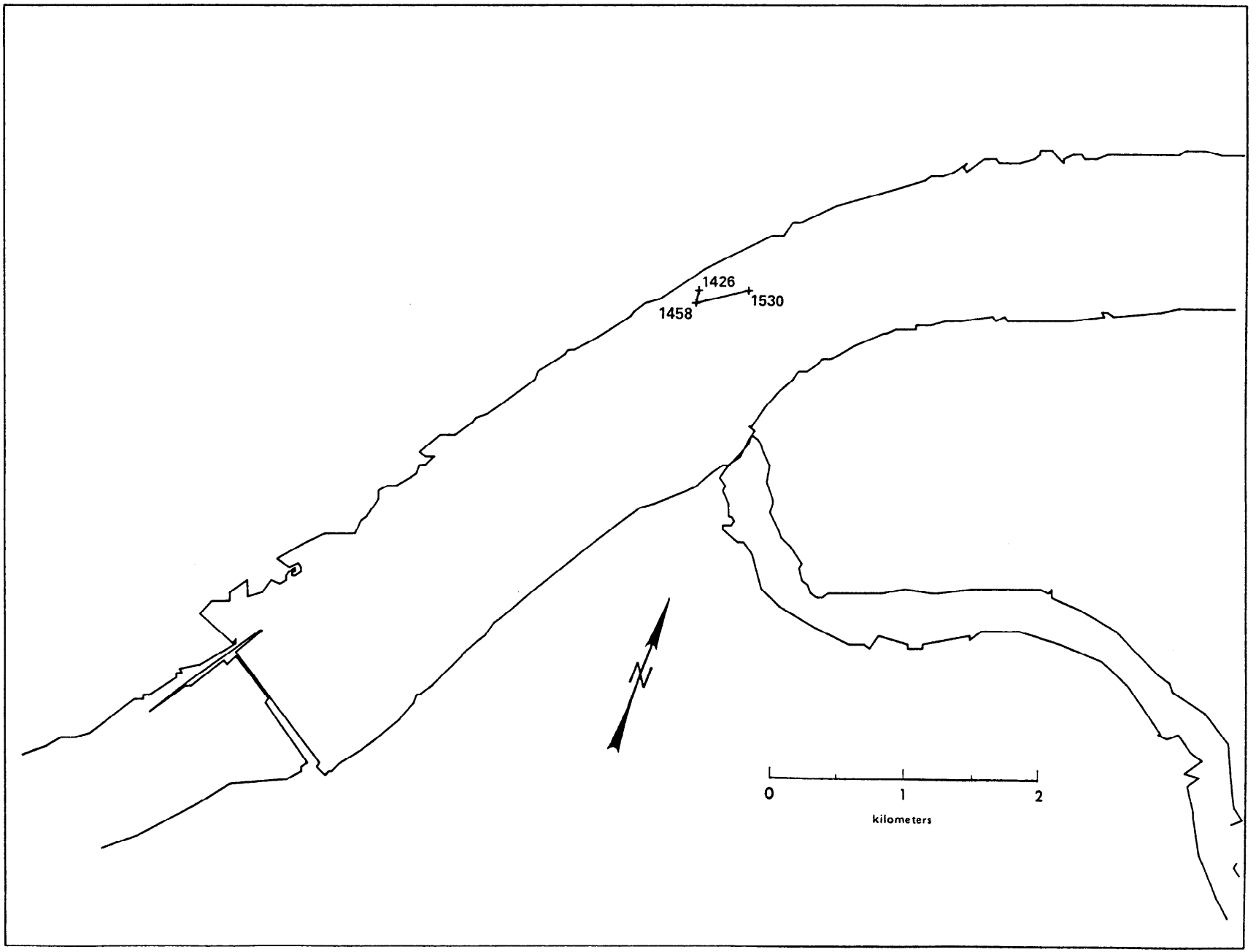
RELEASE DATE: 17 JUNE 1983 INDIVIDUAL FISH CODE: 126

SPECIES: SPRING CHINOOK LENGTH: 149 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAC)	CUMULATIVE DISTANCE	CUMULATIVE TIME
14:26	273.7	0.0	0						
14:58	273.7	0.0	Ø	95	Ø:32	178	173	95	Ø:32
15:3Ø	277.4	0.0	0	400	Ø:32	750	57	495	1:Ø4

#

The release site for this fish was moved downstream and close to the Washington shore because of bad wave conditions further upstream. When weather conditions got worse and the fish moved upstream the track was terminated for the crew's safety.


1426
1530
1458
0
1
2
kilometers

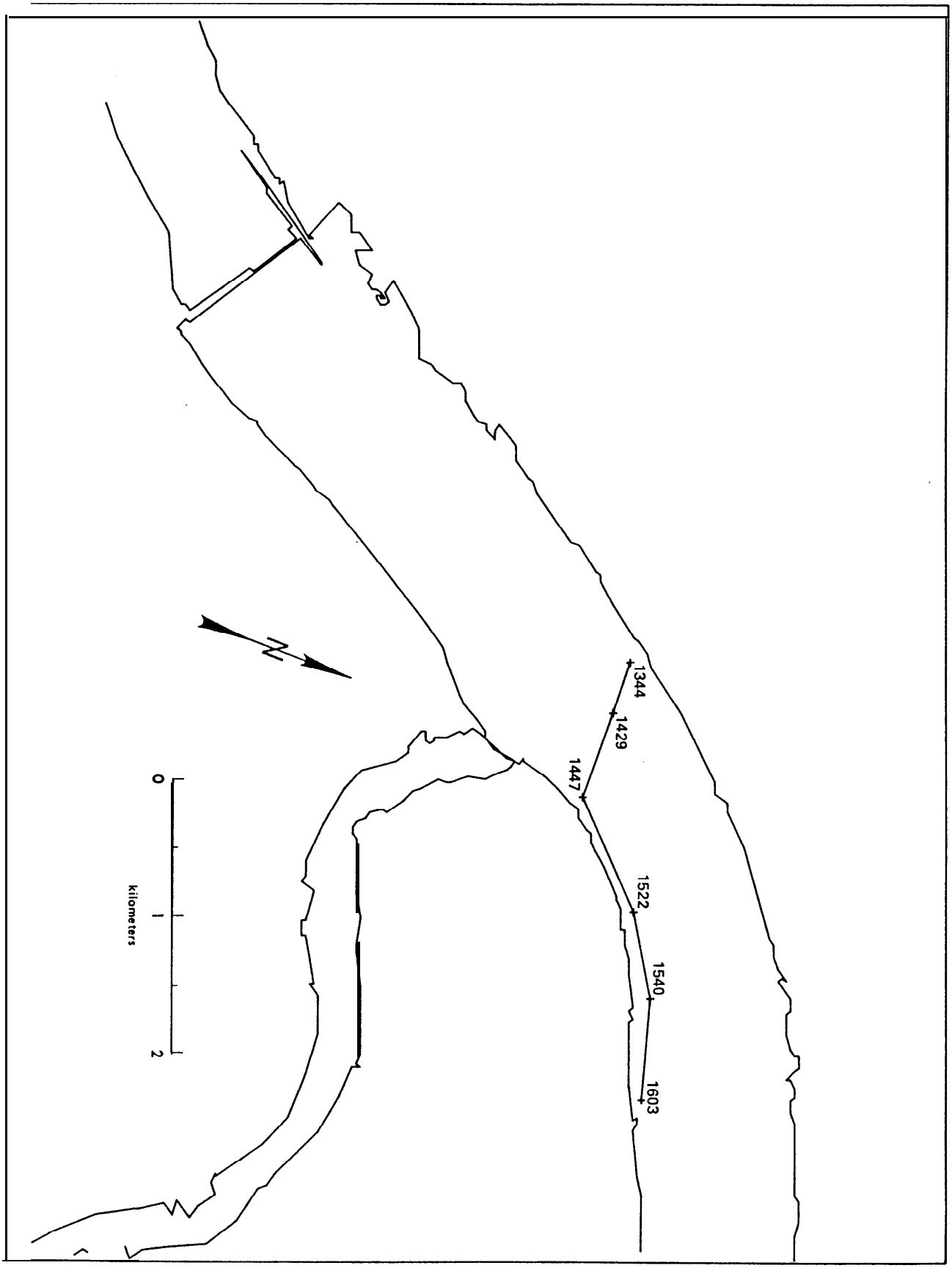
RELEASE DATE: 18 JUNE 1983 INDIVIDUAL FISH CODE: 228

SPECIES: STEELHEAD LENGTH: 183 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:44	258.7	0.0	0						
14: 29	252.7	0.0	0	388	Ø:45	517	89	388	Ø:45
14:47	252.7	0.0	Ø	643	Ø:18	2,143	90	1,031	1:Ø3
15:22	258.6	0.0	0	901	Ø:35	1,545	46	1,932	1:38
15:4Ø	258.6	0.0	0	639	Ø:18	2,130	59	2,571	1:56
16:Ø3	253.7	0.0	0	738	Ø:23	1,925	75	3,309	2:19

#

This fish was released downstream from the normal release area because of rough water. When it crossed to the Oregon shore and upstream the Oregon shore provided protection from the wind. At 1603 the battery in the smaller tracking boat failed and the track was terminated. The spillway monitors recorded the downstream passage at 0022 on 22 June.


1344
1429
1447
1522
1540
1603
0
1
2
kilometers

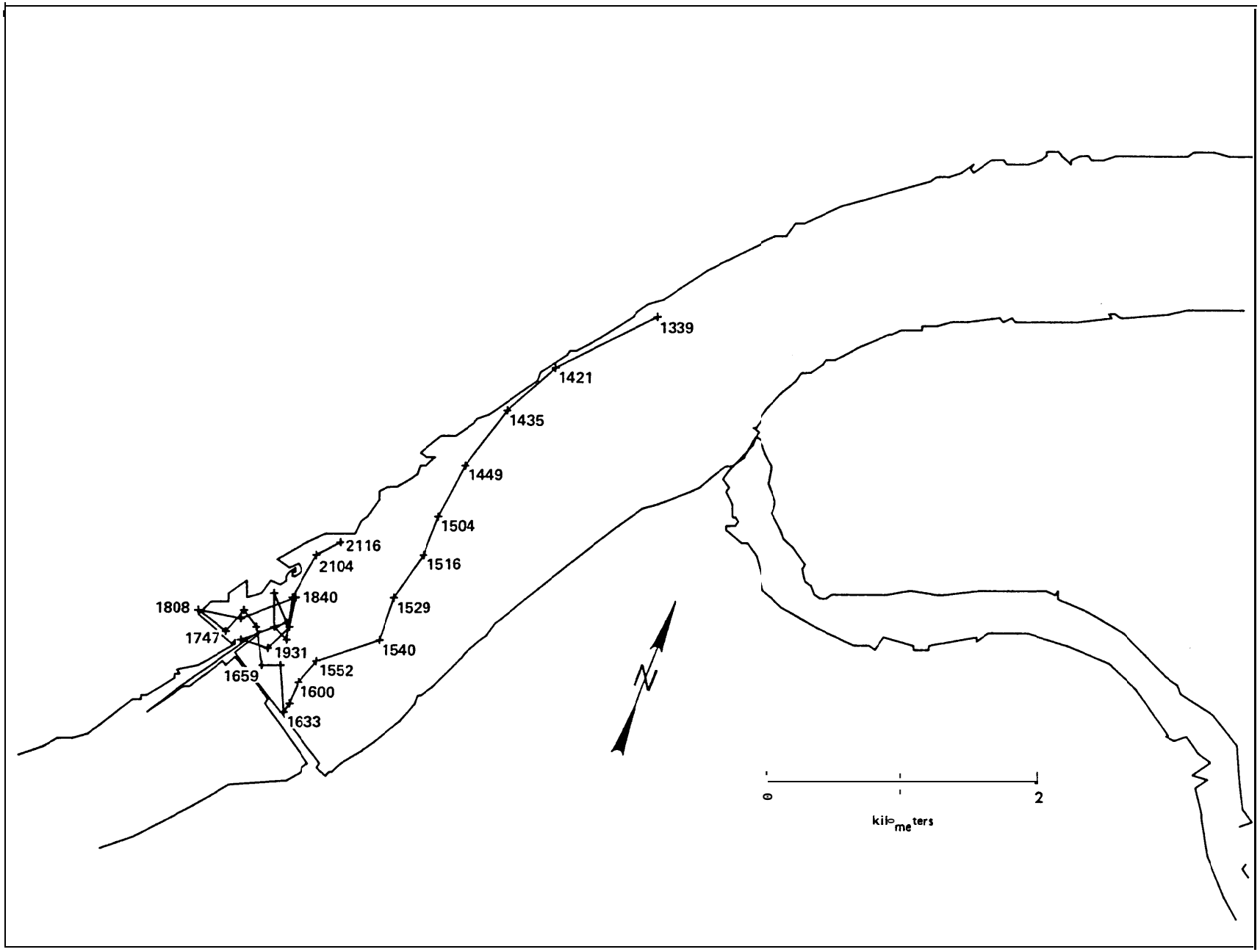
RELEASE DATE: 19 JUNE 1983 INDIVIDUAL FISH CODE: 867

SPECIES: SPRING CHINOOK LENGTH: 150 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAC)	CUMULATIVE DISTANCE	CUMULATIVE TIME
13:39	235.6	0.0	0						
14:21	232.6	0.0	0	823	0:42	1,176	223	823	0:42
14:35	232.6	0.0	0	464	0:14	1,989	208	1,287	0:56
14:49	232.6	0.0	0	503	0:14	2,156	197	1,790	1:10
15:04	228.7	0.0	0	418	0:15	1,672	188	2,208	1:25
15:16	228.7	0.0	0	298	0:12	1,490	181	2,506	1:37
15:29	228.7	0.0	0	377	0:13	1,740	195	2,883	1:50
15:40	228.7	0.0	0	327	0:11	1,784	180	3,210	2:01
15:52	228.7	0.0	0	480	0:12	2,400	231	3,690	2:13
16:00	228.7	0.0	0	202	0:08	1,515	200	3,892	2:21
16:06	228.1	0.0	0	167	0:06	1,670	183	4,059	2:27
16:33	228.1	0.0	0	75	0:27	167	195	4,134	2:54
16:51	228.1	0.0	0	340	0:18	1,133	337	4,474	3:12
16:59	228.1	0.0	0	130	0:08	975	250	4,604	3:20
17:10	226.7	0.0	0	281	0:11	1,533	331	4,885	3:31
17:33	226.7	0.0	0	151	0:23	394	305	5,036	3:54
17:47	226.7	0.0	0	202	0:14	866	200	5,238	4:08
18:08	226.6	0.0	0	248	0:21	709	289	5,486	4:29
18:27	226.6	0.0	0	309	0:19	976	82	5,795	4:48
18:40	226.6	0.0	0	419	0:13	1,934	49	6,214	5:01
19: 00	226.6	0.0	0	220	0:20	660	172	6,434	5:21
19: 11	224.4	0.1	0	216	0:11	1,178	205	6,650	5:32
19: 31	224.4	0.1	0	204	0:20	612	268	6,854	5:52
19:47	224.4	0.1	0	347	0:16	1,301	49	7,201	6:08
20:07	250.5	117.3	47	233	0:20	699	318	7,434	6:28
20:19	250.5	117.3	47	247	0:12	1,235	160	7,681	6:40
20:28	250.5	117.3	47	127	0:09	847	117	7,808	6:49
20:45	250.5	117.3	47	312	0:17	1,101	348	8,120	7:06
21:04	256.4	128.2	50	354	0:19	1,118	9	8,474	7:25
21:16	256.4	128.2	50	196	0:12	980	42	8,670	7:37

#

The release site was moved because of bad weather, but the fish moved downstream. The reaction of this fish to the dam during daylight was to move to the Washington shore. The spillway monitors recorded the downstream passage at 0032 on 20 June.


1339
1421
1435
1449
1504
1516
1529
1540
1552
1600
1633
2116
2104
1840
1808
1747
1931
1659
N
0
2
kilometers

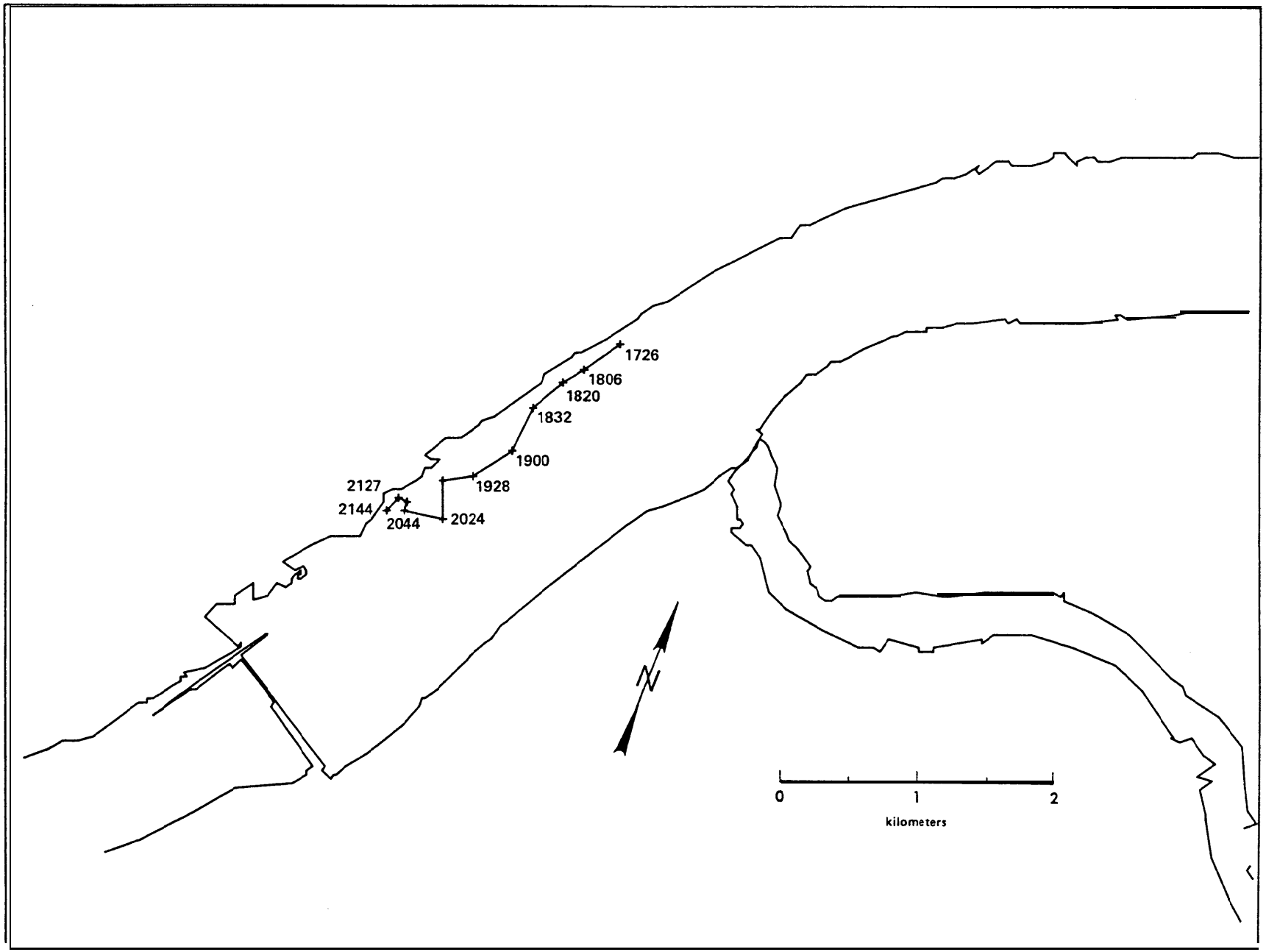
RELEASE DATE: 20 JUNE 1983 INDIVIDUAL FISH CODE: 327

SPECIES: STEELHEAD LENGTH: 187 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTTON (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
17:26	275.4	0.0	0						
18:06	245.6	0.0	0	319	0:40	479	215	319	0:40
18:20	245.6	0.0	0	177	0:14	759	219	496	0:54
18:32	245.6	0.0	0	285	0:12	1,425	210	781	1:06
19: 00	245.6	0.0	0	344	0:28	737	186	1,125	1:34
19:28	202.2	0.0	0	337	0:28	722	217	1,462	2:02
19:53	202.2	0.0	0	218	0:25	523	242	1,680	2:27
20:24	283.6	131.5	46	278	0:31	538	160	1,958	2:58
20:44	283.6	131.5	46	288	0:20	864	263	2,246	3:18
21:08	297.0	148.8	50	65	0:24	163	360	2,311	3:42
21:27	297.0	148.8	50	72	0: 19	227	276	2,383	4:01
21:44	297.0	148.8	50	127	0:17	448	203	2,510	4:18

#

High winds and rough water caused us to release the fish closer to the dam. Tag problems with an earlier released fish was the reason for the late release time. The fish moved very slowly and was not progressing downstream when the track was terminated.


1726
1806
1820
1832
1900
1928
2024
2127
2144
2044
N
0
1
2
kilometers

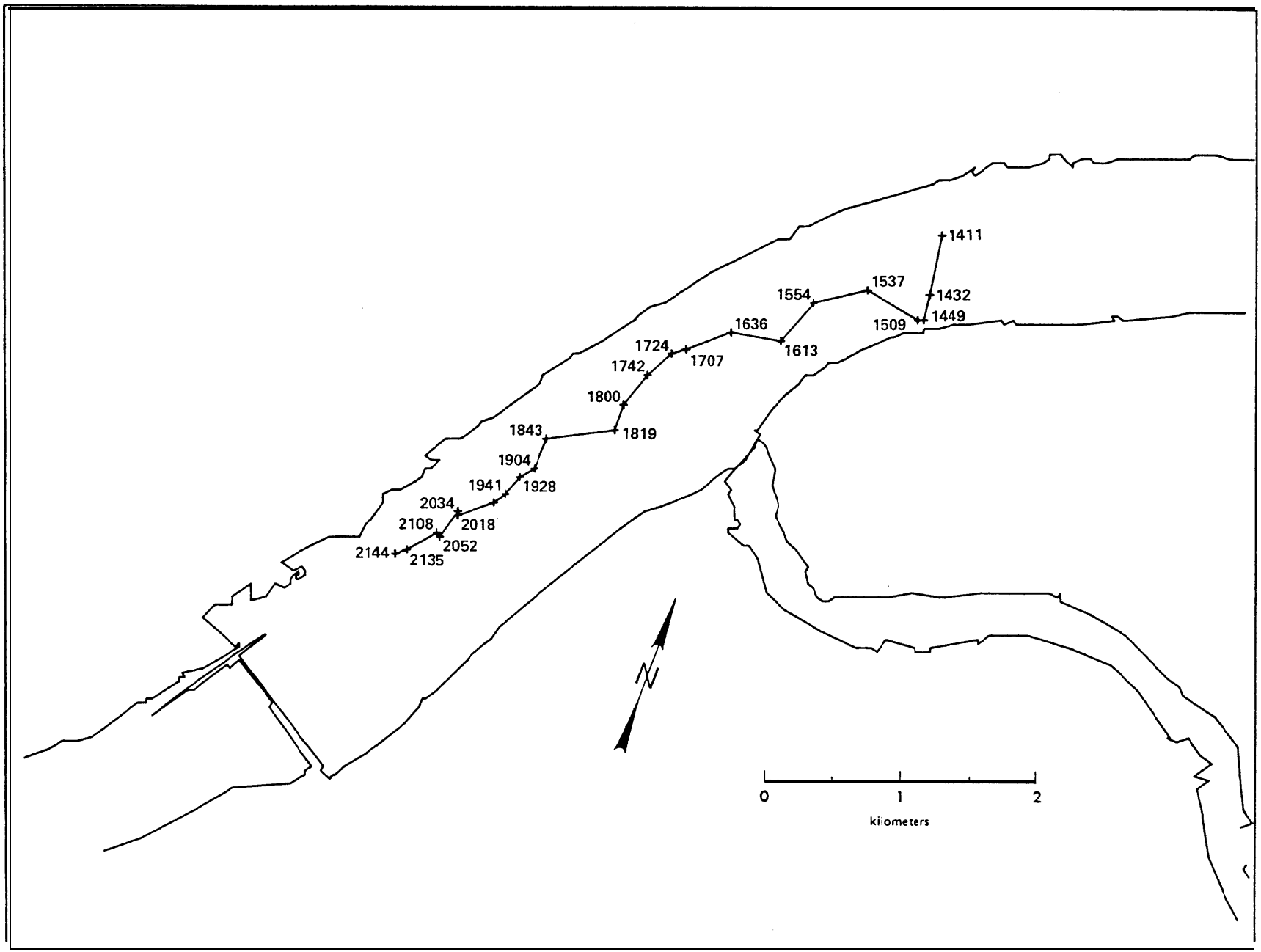
RELEASE DATE: 22 JUNE 1983 INDIVIDUAL FISH CODE: 170

SPECIES: STEELHEAD LENGTH: 173 MM

TIME	FLOW (KCFS) TOTAL	SPILL	PERCENT SPILL	DISTANCE (METERS)	TIME SPAN	VELOCITY (M/HR)	DIRECTION (DEG MAG)	CUMULATIVE DISTANCE	CUMULATIVE TIME
14:11	253.2	3.2	1						
14:32	253.2	3.2		441	0:21	1,260	172	441	0:21
14: 49	253.2	3.2	1	190	0:17	671	173	631	0:38
15:09	252.3	3.2	1	43	0:20	129	250	674	0:58
15:37	252.3	3.2	1	426	0:28	913	281	1,100	1:26
15:54	252.3	3.2	1	400	0:17	1,412	237	1,500	1:43
16:13	252.6	3.2	1	366	0:19	1,156	201	1,866	2:02
16:36	252.6	3.2	1	373	0:23	973	260	2,239	2:25
17:07	252.5	3.2	1	347	0:31	672	229	2,586	2:56
17:24	252.5	3.2	1	112	0:17	395	234	2,698	3:13
17:42	252.5	3.2	1	232	0:18	773	208	2,930	3:31
18:00	252.5	3.2	1	277	0:18	923	199	3,207	3:49
18:19	250.6	3.2	1	196	0:19	619	180	3,403	4:08
18:43	250.6	3.2	1	501	0:24	1,253	243	3,904	4:32
19:04	220.3	3.2	1	233	0:21	666	182	4,137	4:53
19:28	220.3	3.2	1	124	0:24	310	220	4,261	5:17
19: 41	220.3	3.2	1	164	0:13	757	201	4,425	5:30
19: 59	220.3	3.2	1	106	0:18	353	215	4,531	5:48
20:18	263.3	60.3	23	276	0:19	872	231	4,807	6:07
20:34	263.3	60.3	23	31	0:16	116	340	4,838	6:23
20:52	263.3	60.3	23	226	0:18	753	195	5,064	6:41
21:08	288.8	79.2	27	38	0:16	143	305	5,102	6:57
21:35	288.8	79.2	27	249	0:27	553	220	5,351	7:24
21:44	288.8	79.2	27	92	0:09	613	231	5,443	7:33

#

This was the last track of the season. The fish moved downstream at a very slow rate and the track was abandoned when movement did not increase after dark. The tag was recorded by the spillway monitors at 0738 on 23 June, but was not counted as a passage because the spill gates were on the sill at the time and the monitors were removed from the dam.


1411
1537
1554
1432
1449
1509
1636
1613
1724
1707
1742
1800
1819
1843
1904
1941
1928
2034
2018
2108
2052
2144
2135
0
1
2
kilometers